50 Golden Years of the 104cm Sampurnanand Telescope

Walking Down the Memory Lane...

October, 2022

Memoirs…

Golden Memories

Dr. B. N. Ashoka

We the members of ISRO team Dr. Seetha and myself under the leadership of Dr. Marar was involved in a collaborative project with the erstwhile UPSO. Our aim was to carry on the fast photometric observation using our two/three star photometer on the 1.04-m telescope. We came to know that NainiTal has good sky conditions. Dr. Marar and myself made a visit in 1989 to assess the logistics to set up a collaboration. Dr. M. C. Pandy then the Director of UPSO welcomed our visit and assessed our program and assured us a good amount of telescope time. At the same time he apprised us of the limitations in the observatory in terms available equipment and logistics because it was under UP State Govt. He also explained to us the limitations related to our living conditions in terms of food, transport and accommodation. He told us there is no guest house and canteen but we will arrange a cook whom you should pay and get him all the raw items. He can prepare food in the place where night time coffee is made using a kerosene stove. But, he assured us that he would make our stay livable. We too promised him that as long as we get good data all other conditions and limitations are secondary. Then he formed a team from UPSO consisting of Dr. SK Gupta, Dr. U. S. Chaubey and Dr. Bhatt, for the collaborative program with the ISRO team.

Our first official visit was in 1989. We carried our two star photometer. We traveled by a taxi from Delhi to NainiTal and carried with us all the required kitchen items for our cook. We started our first observations on the 1.04-m telescope with our photometer. We noticed that the telescope was well maintained. Pointing and tracking was good. The sky conditions were photometric. We observed for a week and got good data and gained confidence that it is the right place to continue our collaboration.

Then onwards we started our planned observations with a minimum of one visit every year for a stretch of min 10 days. In one of our visits we carried a MIcro Advance DeskTop PC from Bangalore to NainiTal since there was no PC available in the telescope room. However, with time all the observing facilities were made available in the observatory. The
Next Director Dr. H. S. Mehara Ji was kind enough to get us all possible facilities and continued the support to our group. We continued time series photometric observations of CVs. We also continued our WET campaigns from Nainital for the Asteroseismological studies of pulsating white dwarf stars. Meanwhile, we modified our two channel photometer to a three channel photometer which helped us to get continuous data without brakes.
Generally such continuous data is preferred to avoid aliases in the DFT. When UPSO came under DST due to the immense vision of the next Director Prof. Ram Sagar, the logistics improved considerably in the observatory. He was kind enough to allot us a good number of nights for our program in spite of increased demand for observing nights due to many research students. He was kind enough to become my guide for my PhD together with Dr. Seetha. The data obtained mainly from UPSO 1.04-m telescope and one WET observation involving 1m telescope on a CV is the basic data for my thesis. We duplicated and made one more full unit of a three star photometer and left it permanently since 1998 for our mutual usage.

Since NainiTal sky conditions were very good and UPSO is in the northern hemisphere and since we were involved in time series photometric observations; a new requirement came from

SAAO. Prof. Don Kurtz and his team proposed a possibility for the study and survey of RoAp stars from UPSO. He made a pilot visit in 1997 and used our photometer on the 1.04-m telescope. He could easily detect millimagnitue variations in time series photometric data in real time on the computer screen. He assessed the excellent photometric sky conditions. He declared that this place is fit to establish the collaboration for the survey of rapidly oscillating Ap (roAp) stars in the northern sky.

The RoAp star survey got the DST approval with the participation of UPSO, NainiTal, ISRO, Bangalore and SAAO. Santosh from UPSO and Girish from ISRO became the first PhD students to work on this programme. They successfully completed their PhD using the data from the 1.04-m telescope. After Kurtz, Peter Martinez took charge of this project from SAAO. Dr. Santosh, even after his PhD, now continues this project using the fast CCD photometer. He extended his collaboration with a few more countries including Belgium.

Now the institution is renamed as ARIES which is an appropriate name to date. The commissioning of the 3.6-m telescope at Devasthal is the witness for the remarkable growth and capability of the institution. The effective management and use of the 1.04-m telescope for 50 years in this best site is the power behind this growth. The Golden Jubilee celebration reminds the history of the 1.04-m telescope and the progress of the institution. This event is a motivation for the younger generation.

Wish all the best for your celebration.

BNA

मेरी यादों में **104** सेंटीमीटर दूरबीन

डॉ बसंत बल्लभ सनवाल
भूतपूर्व वैज्ञानि क, एरीज

मुझे यह जान कर अत्यंत हर्ष है कि 104 सेंटीमीटर दूरबीन के 50 वर्ष की उपलब्धियों पर यह आयोजन हो रहा है। लगभग 39 वर्षों तक संस्थान में मेरी भूमि का इस दूरबीन से संबंधित लगभग सभी कार्यकलापों में एक सहयोगी के रूप में रही है। सर्वप्रथम मैं इस संस्थान की अग्रणी दिवंगत पुण्य आत्माओं को अपने श्रद्धा सुमन अर्पित करता हूं जिनके प्रताप से आज संस्थान विश्व पटल पर एक प्रतिष्ठित शोध संस्थान के रूप में ख्याती अर्जित कर चुका है।

डॉ संपूर्णानंद जिनकी दूरदृष्टि तथा आधुनिक खगोल विज्ञान में रुचि से उत्तर प्रदेश राजकीय वेधशाला की स्थापना हुई और उनके सम्मान में दूरबीन का नामकरण किया गया। डॉ एम के वी बप्पू जिनकी प्रतिभा के फलस्वरूप इस संस्थान को आधुनिक खगोल विज्ञान का आधार प्राप्त हुआ और आधुनिक दूरबीन तथा प्रेक्षण सुविधाओं की स्थापना प्रारंभ हुई। डॉ एस डी सिंव्हल जिनके सफल निर्देशन में दूरबीनो और प्रेक्षण सुविधाओं की स्थापना हुई तथा संस्थान को अंतरराष्ट्रीय ख्याति प्राप्त हुई। डॉ एच एस महरा जिनका इलेक्ट्रॉनिक्स उपकरणो को बनाने में सफल योगदान रहा। डॉ सी डी कांडपाल जिनका फोटोमीटर के डि जाइन और निर्माण तथा दूरबीन के रख रखाव में किया कार्य उल्लेखनीय है । डॉ एस सी जोशी जिनका कैसेग्रेन स्पेक्ट्रोग्राफ के निर्माण में योगदान रहा। डॉ एम सी पांडे जिन्होंने निदेशक के रूप में नवीन उपकरणों के आयात तथा उनकी स्थापना के लिए प्रोत्साहित किया। श्री निकलसन दासजी जिनका सभी उपकरणों के यांत्रिकी निर्माण तथा उनकी स्थापना में सर्वाधिक महत्वपूर्ण योगदान रहा है।

प्रो रामसागर के निदेशक का पदभार ग्रहण करने के बाद दूरबीन से प्रेक्षण पर आधारित शोध के कई नए विषय प्रारंभ किए गए तथा संस्थान का आर्यभट्ट प्रेक्षण विज्ञान शोध संस्थान के रूप में अवतरण हुआ फलस्वरूप संस्थान का सर्वांगीण विकास तथा आधुनिकीकरण किया गया। डॉ वहाब उद्दीन तथा डॉ अनिल पांडे के कार्यकाल में भी दूरबीन के उपयोग को प्राथमिकता दी गई। वर्तमान निदेशक प्रो दीपांकर बनर्जी पूर्ण मनोयोग से संस्थान के आधुनिकीकरण तथा नवीन शोध विषयो पर उत्कृष्ट कार्य के लिए अपना श्रेष्ठतम योगदान प्रदान कर रहे हैं।

डॉ बप्पू द्वारा 104 सेमी दूरबीन की लगभग सभी तकनीकी विशेषताओं को निर्धारित किया गया तथा निर्माण के लिए कार्ल ज़ाईस, जर्मनी का चयन किया। दूरबीन क्रय, आयात तथा स्थापना के सभी कार्य डॉ सिंव्हल के निर्देशन में अत्यंत उत्कृष्टता से किए गए। दूरबीन भवन का डोम टी एस एल इलाहाबाद द्वारा बनाया गया। डोम में विडं स्क्रीन की स्थापना में फर्म असफल रही। दूरबीन भवन के निर्माण के समय ही यांत्रिकी कार्यशाला द्वारा एक ऑब्जर्वर्स प्लेटफार्म का निर्माण कर दूरबीन भवन में स्थापित किया गया जिसकी सहायता से वैज्ञानिक दूरबीन की किसी भी स्तिथि में दूरबीन के कैसेग्रेन फोकस तक जा सके। यह प्लेटफार्म ऊपर, नीचे, दाएँ, बाएँ तथा फर्श पर गोलाई में चलने में सक्षम था। सी सी डी कैमरा लगने के बाद इसकी उपयोगिता नहीं रही।

किसी भी दूरबीन की कार्यकारी अवधि लगभग 50 वर्ष होती है अतः संपूर्णानंद दूरबीन की इस अवधि का योगदान अद्वितीय रहा है। लगभग 450 शोध पत्रों का प्रकाशन तथा 60 शोथ प्रबंधों का प्रस्तुत किया जाना दूरबीन के पूर्ण सार्थक उपयोग का प्रमाण है। इसका प्रमुख कारण दूरबीन का विशेष डिजाइन तथा सभी उपकरणों का उचित रखरखाव रहा है। इस कार्य में सभी टेक्निकल कर्मचारियों का पूर्ण मनोयोग से कार्य किया जाना उल्लेखनीय है। दूरबीन विशेष रूप से निकट होराइजन तथा निकट उत्तरी ध्रुव तक ऑब्जर्व करने में सक्षम है। यह विशेषता विशेष रूप से धूमकेतु के प्रेक्षण के लिए उपयोगी है। सभी शोध कार्यों में कैसेग्रेन फोकस पर लगे उपकरणों का उपयोग किया गया। उक्त हेतु डी सी एम्प्लीफायर, फोटोमीटर कूलिंग यनिूट आदि अन्य कई इलेक्ट्रॉनिक्स उपकरणों के डिजाइन तथा निर्माण में डॉ एच एस माहरा और डॉ एस के गुप्ता तथा उनकी टीम ने सार्थक तथा महत्वपूर्ण कार्य

किए। कूदे फोकस पर लगने वाले वर्णक्रम लेखी के लिए दिए गए प्रकाश पथ डिजाइन पर मैंने आधारभूत त्रुटि पाई, जिसका निवारण कठिन था अतः इस फोकस का उपयोग नहीं किया गया।

दूरबीन की क्षमता बनाए रखने के लिए दूरबीन के दर्पण को समय समय पर एल्यूमिनाइज करना आवश्यक होता है। इसके लिए एक वैक्यूम एल्यूमिनाइजिंग प्रणाली की परिकल्पना तथा डिजाइन संस्थान मे डॉ टी डी पडलिया, डॉ एस डी सिंव्हल, श्री के जी गुप्ता तथा मेरे द्वारा किया गया। कंट्रोल सिस्टम डॉ एस के गुप्ता तथा उनकी टीम द्वारा डिजाइन किया गया और संस्थान में ही बनाया गया। देश में ही निर्मित आवश्यक अवयव क्रय किए गए। वैक्यूम पाइप लाइन तथा वैक्यूम वाल्व का निर्माण संस्थान की यांत्रिकी कार्यशाला में किया और पूरे सिस्टम को एसेंबल कर सफल परीक्षण करने के उपरांत श्री के जी गुप्ता, श्री एल एम पाठक, श्री विपिन पंत द्वारा अपनी टीम के सहयोग से प्राथमिक दर्पण को एल्यूमिनाइज किया तथा पुनः दूरबीन में सफलता पूर्वक स्थापित किया।

इस दूरबीन के ऑब्जर्वेशंस पर आधारित अंतरराष्ट्रीय ख्याति अर्जित शोध पत्रों के प्रकाशन हेतु उपयोग में लाए गए उपकरणों का उल्लेख न किया जाना न्यायोचित नहीं है। अतः कुछ का विवरण तथा उनका अलग अलग उपयोग इस प्रकार है।

कैसेग्रेन प्लेट होल्डर तथा मीनल कैमरा दूरबीन के साथ आयात किए गए। प्रारंभ में दूरबीन की क्षमता तथा एलाइनमेंट के लिए इनका उपयोग किया गया। कैसेग्रेन प्लेट होल्डर 35 आर्क मिनिट क्षेत्र का उपयोग करने में सक्षम है। इसके डिजाइन में आवश्यक परिवर्तन कर, बड़ी साइज की सी सी डी के उपयोग से वाइड फील्ड इमेजिंग की जा सकती है। यू बी वी फोटोइलेक्ट्रिक फोटोमीटर, निकट अवरक्त फोटोमीटर तथा कैसेग्रेन स्पेक्ट्रोग्राफ का निर्माण मुख्य रूप से संस्थान के आंतरिक संसाधनों की सहायता से किया गया उक्त के लिए ऑप्टिक्स तथा फोटोमल्टिप्लायर ट्यूब का आयात किया गया। एक लेबोरेटरी स्पेक्ट्रोग्राफ को डॉ जी एस डी बाबू तथा डॉ बी एस रौतेला के प्रयास से स्पेक्ट्रोफोटोमीटर के रूप में विकसित किया गया। इसका उपयोग प्रमुख रूप से तारों के स्पेक्ट्रल एनर्जी डिस्ट्रीब्यूशन पर आधारित शोध में तथा धूमकेतुओं के अध्ययन में किया गया। 1989 में डॉ विजय मोहन ने प्रेक्षण सुविधाओं के आधुनिकीकरण के महत्वपूर्ण कार्य के रूप में 384x576 पिक्सल के सी सी डी कैमरा तथा आधुनिक कंप्यूटर प्रणाली की स्थापना की। कंप्यूटर प्रणाली सी सी डी से प्राप्त इमेज की प्रोसेसिगं के लिए आवश्यक होती है। इन सविुधाओं का उपयोग कर डॉ विजय मोहन द्वारा दो इंडो फ्रेंच शोध परियोजनाओं का सफल संचालन किया गया जिसके लिए उनको विशेष प्रशस्ति मिली। कालांतर में 1024x1024 तथा 2048x2048 पिक्सल सी सी डी कैमरा प्रणाली को भी स्थापित किया गया। इनकी स्थापना से प्रेक्षण क्षमता में लगभग 200 गुना की उल्लेखनीय वृद्धि हुई। लंबी अवधि के एक्सपोजर के लिए ऑटो गाइडर के रूप में, 20 सेमी दूरबीन में स्थापित एसबीआईजी के एस टी 4 का उपयोग अत्यंत महत्वपूर्ण तथा सफल रहा। मूल कंट्रोल सिस्टम में आई कमियों का नवीन तकनीक का उपयोग कर, आई आई ए बैंगलोर तथा डॉ एस के गुप्ता के द्वारा समाधान किया गया।

तीन चैनल फास्ट फोटोमीटर ने वर्ष 2000 से कार्य करना प्रारंभ किया। इसका निर्माण एवम स्थापना आंतरिक संसाधनों द्वारा डॉ संतोष जोशी के प्रयास से की गई। डॉ बी एस रौतेला तथा उनकी टीम द्वारा भी आंतरिक संसाधनों का उपयोग कर तथा आवश्यक ऑप्टिक्स का आयात कर इमेजिंग पोलैरीमीटर विकसित किया गया जो वर्ष 2004 से कार्य कर रहा है।

प्रारंभिक प्रेक्षण कार्यक्रम आधुनिक नहीं थे। अतः दूरबीन की क्षमता के अनुरूप प्रथम बार, प्रो रामसागर तथा डॉ उमेश जोशी द्वारा एक अति महत्त्वपूर्ण, अत्यधिक श्रम एवम एकाग्रता पर आधारित ओपन स्टार क्लस्टर की यू बी वी फोटोमेट्री का कार्यक्रम लिया गया। उस समय क्लस्टर के प्रत्येक तारे को एक एक कर दूरबीन के कैसेग्रेन फोकस पर देख कर प्रेक्षण लिए जाते और स्ट्रिप चार्ट रिकॉर्डर पर अंकित किए जाते थे। इस कार्य के लिए तथा दूरबीन के रखरखाव में दक्षता पूर्ण किए कार्यों के लिए मेरी स्मृति में श्री एस एल नौटियाल, श्री भागवत नेगी, श्री ए के सिहं का नाम विशषे रूप से अकिंत है।ओपन स्टार क्लस्टर पर आधारित शोध को अंतरराष्ट्रीय स्तर पर प्रमाणिक तथा नवीनतम माना गया । कार्यक्रम को अभी भी प्राथमिकता के आधार पर लेकर कई शोध प्रबंध

प्रस्तुत किए जा चुके हैं।

स्पेक्ट्रोफोटोमीट्री पर आधारित बीई तारों, सेफिड्स, धूमकेतुओं का अध्ययन किया गया। प्रेक्षण सुविधाओं के आधुनिकीकरण के बाद क्वेजर्स, ब्लेजर्स, नोवा, सुपरनोवा,एक्टिव गैलेक्टिक न्युक्लियाई, रेपिडली ऑसिलेटिगं एपी तारों, आई आर ए एस सोर्स, एम 31 की तरफ माइक्रोलेंसिगं घटनाएं आदि प्रमखु शोध विषय रहे हैं। इन विषयों पर आधारित शोध पत्रों को अंतरराष्ट्रीय शोध पत्रिकाओं में प्रकाशित किया गया है।

इस दूरबीन का उपयोग पी आर एल अहमदाबाद द्वारा उनके द्वारा विकसित निकट अवरक्त फोटोमीटर का उपयोग कर पहली बार देश में अवरक्त तारों के प्रेक्षण लिए गए। यह कार्यक्रम 1977 से 1983 तक चला। इसरो द्वारा विकसित तीन चैनल फास्ट फोटोमीटर का उपयोग चार कांति तारों पर शोध के लिए किया गया। आई आई ए बैंगलोर द्वारा विकसित पोलैरीमीटर तथा 4केx4के सी सी डी कैमरा की क्षमता के आकलन और प्रेक्षण के लिए भी इसी दूरबीन का उपयोग किया गया।

यहाँ कुछ ही नामों का उल्लेख किया गया है, इसका यह अर्थ नहीं है कि संपूर्ण कार्य इनके द्वारा अकेले ही संपादित किए गए। कोई भी कार्य संस्थान के प्रत्येक कर्मचारी की सहभागिता सुनिश्चि त किए बिना कभी भी सम्पन्न नहीं होता। यहाँ भी संस्थान के सभी वैज्ञानिकों, टेक्निकल, प्रशासनिक तथा सहायक कर्मचारियों का पूर्ण क्षमता से संस्थान के विकास में उल्लेखनीय योगदान रहा है।

इस प्रकार दूरबीन ने विगत 50 वर्षों में पूर्ण क्षमता के साथ विविध शोध कार्यों में तथा विविध शोध हेतु इंस्ट्रूमेंट्स के विकास में महत्वपूर्ण भूमिका निभाई। अतः स्थापना का उद्देश्य पूर्ण रूप से सफल रहा। प्रो जयंत नार्लीकर द्वारा एक लेख में दूरबीन को खगोलविदों का दिव्य चक्षु कहा गया है। मेरी अपेक्षा है कि वर्तमान उदीयमान खगोलविद दूरबीन की दिव्यता को बनाए रखने में पूर्ण मनोयोग से कार्य करेंगे तथा संस्थान के सर्वांगीर्ण विकास में अपना श्रेष्ठतम योगदान देंगे।

Bhuwan C. Bhatt
Indian Institute of Astrophysics, Bengaluru

I have many good and fond memories of UPSO (presently ARIES). I joined UPSO on 11th April, 1985 as a Research Fellow and first started working on site testing related to UPSO 4-m telescope project. There were no graduate courses or special training for Research Fellows at that time. I was asked to do everything by myself by discussing and learning from fellow scientists and engineers/technicians etc. I read a lot and learnt how to present the data. I started analyzing the weather data, collected at 4-5 stations in Shivalik mountain ranges from 1980 onward. I was given complete responsibility of field stations for supervision and for providing other logistic support to these stations.

I was at my office room at UPSO (1988)

I was introduced to the 104-cm Sampurnanand Telescope for the first time by Dr. Mahendra Singh during October 1985. He trained me in telescope operation and data collection devices such as three filter photometer for photoelectric photometry, monochromater for spectroscopy connected with photon counter technique as well as an ink chart recorder. My first observations were of Comet Halley which appeared during 1985-1986. Later I joined Dr. H. S. Mahra and Dr. Anil K. Pandey for my research work in the field of Galactic Open clusters. Initially, I started photoelectric photometry of stars in the region of selected star clusters. In this process, I have taken photos of cluster regions with an emulsion film plate holder attached with the 104-cm Sampurnanand Telescope. Parallely, we had to prepare for a darkroom to develop and fix the

photo plates. From the developed films, Mr. M. C. Tewari helped us in getting the B/W photo print of this cluster region. This photograph helps us in identifying the cluster region and navigating cluster stars to put one by one in a photometer diaphragm and to perform the UBV photometry with the help of a photon counter/chart recorder. This was the whole night task if it is clear. First, we have to calibrate the console dials for local sidereal time (LST), then put a bright star to guide scope (attached and aligned with the main telescope) to get the pointing corrections that were applied to the console dials. Pointing the field for photography/photometry and then the real task starts for guiding the telescope manually by looking at the bright star continuously and bringing it to cross-wire. If it is photography then exposure time goes to 1 hour to 2 and half hours sometimes, and thus real task was tough guiding manually with continuously looking at the star on guide scope, hanging with the telescope ladders and trolley for that duration and in the cold of Nainital. The trauma use to be in waiting, immediately develop plate holder film and if guiding is not proper, we have to hang again for next same duration to get the right photograph. Late Dr. Anil K. Pandey played a key role in my whole research career which started with observations through the 104-cm Sampurnanand telescope at UPSO (now ARIES) to my next workplace at IIA, Bangalore.

Myself outside telescope dome after completing night observations on 30/31 October 1987.

Apart from my regular observations of start clusters, I was involved in the Asteroid occultation events also. For this, time keeping used to be very important. We used to calibrate the clocks/charts near Telescope with the BBC timings from the radio or time signal of the time signal tower installed near the Backer-Nunn camera. I contributed to many occultation

observations but did not get success in recording any of the events.

Meanwhile, during 1987-1988, one small 576x384 pixel Photometrics CCD system was commissioned with 104-cm Sampurnanand Telescope and observations were little easy. Initially automation was not complete and for filter change one had to be near the telescope for changing the filters manually and guiding the telescope as well. But data recording with CCD was easy and reduction in exposure time and getting multi star image data helped us in comparison to the much toiling tasks during conventional photometry. Anyway, I started my photometry work with this new CCD system and published results and included this work in my Ph. D. thesis.

Apart from my regular Ph.D. research work I have contributed to many visiting observers programmes. I have worked with ISRO people to work on their 2 channel photometer initially and later with 3 channel photometer attached with the 104-cm telescope. I had worked with other proposals from IIA, TIFR and PRL also and helped in observations with this telescope.

Apart from observations with the 104-cm telescope, I had worked on other activities related to the 104-cm Sampurnanand Telescope. During monsoon time, the telescope used to be shut down for observations. Before opening in Sept-October, I took part in washing the main mirror with distilled water. This task I had done with Mr. K. G. Gupta, Optics Engineer. I did cleaning/Baking of the photometer also with Dr. J. B. Srivastava. I had actively participated in the installation of CCD systems (old and new 1kx1k) and the ST-4 auto-guiding system. I was engaged in development of multiuser computer systems for CCD data reduction/analysis (Micro-Vax-II system and Sun workstations) in the old building (1989) as well as shifting it to the new building (1992) under supervision of Dr. Vijay Mohan. I used to help in transferring the CCD data from the telescope to the computer systems and make archival with big tape discs and later in tape cartridges.

It is worth mentioning that UPSO in our time was not well equipped with manpower and resources as we see today. The research scholars get support from the Institutes. We did not have a mess/canteen for our food. I used to reside in the new dormitory (today it is Post Doc house). There were few rooms and I shared my time at the dormitory with Dr. Anil K. Pandey, Dr. Wahab Uddin, Dr. D. K. Ojha (presently at TIFR), Mr. Dinesh Paliwal (presently in business) and Dr. Anita (in Uttarakhand Govt.). We used to continuously work at the office/observatory and to save time coming/going from the office, our routine was cooking breakfast/lunch/dinner all together in the morning and taking packed lunch/dinner to the office by 10:00 am. After midnight only we come back to the dormitory and prepare the same way for the next morning. There was no helper for cooking/washing utensils and we all used to do all the household ourselves with shared responsibilities.

A sufficient part of my time at UPSO was spent in night observations/work with the 104-cm Sampurnanand Telescope and data reduction/analysis. At that time, a 100 star photometry itself took 5-6 hours of computer time. Sometimes it used to be a whole night job if multiple images were loaded to the computer system for analysis. At the telescope, I remember, when I started observing, one night technician used to be on duty for helping in observations, because if the

astronomer is on the telescope, somebody has to be at the chart recorder to keep time series and marking the object/filters etc. The technician used to help in power failure and other small troubleshoots. But once CCD systems were installed, this help was withdrawn. I remember, we used to do all the observations single handedly and the whole night we used to run between data acquisition computers and the telescope to change the filters which were not automated initially. And then guiding also was to be done manually sometimes when exposure time was beyond 5 mins. Most of the time, on our nights schedule, we used to fill up nitrogen in the CCD dewar in the evening. Very often, during power failure, I had started the DG sets also to do the observations. We used to give company to our roommates (especially with Ojha, Paliwal) and help each other for observations on allotted nights.

During 1992, the 1kx1k Photometrics system was installed replacing the smaller chip on the 104-cm telescope. I continued my observation of star clusters with this CCD also. Comet Shoemaker–Levy 9 (formally designated D/1993 F2) broke apart in July 1992 and collided with Jupiter in July 1994, providing the first direct observation of an extraterrestrial collision of Solar System objects. This event was also covered by the 104-cm Sampurnanand Telescope during July 1994. From UPSO's side I also participated in this event. Despite heavy monsoon clouds in mid-July, we were able to get pre and post hit CCD images of the planet Jupiter.

After the award of Ph.D. (from Kumaun University) in December 1993, I continued at UPSO for some more time and left this Institute to join Indian Institute of Astrophysics as Post Doctoral Fellow and resumed my journey in Astronomy & Astrophysics at VBO, Kavalur. Later I was posted in Ladakh for development of the Indian Astronomical Observatory and setting up of the 2-m Himalayan Chandra Telescope in Hanle-Ladakh. Then onward, I have been continuously working at CREST/IIA in Hoskote/Bangalore.

Amazing Journey: my success with the 104-cm Sampurnanand telescope @ Nainital

C. S. Stalin
Indian Institute of Astrophysics, Bengaluru

It gives me immense pleasure when I was asked to write a memoir on the occasion of the Golden Jubilee celebration of the 104-cm Sampurnanand telescope (ST) at Nainital. I consider myself to be fortunate enough to be associated with the 104-cm telescope while it was going through various phases, a phase of ***obscuration and neglect*** (prior to 1997) when it was operated by the then Uttar Pradesh State Observatory (UPSO), a phase of ***prominence*** both in the national and international scene (1997 – 2002) owned and operated in the first half of the said period by UPSO and in the second half of the said period by the State Observatory (SO), Uttarakhand and then a phase of ***maturity and steadiness*** (post 2004) owned and operated by the now Aryabhatta Research Institute for Observational Sciences (ARIES).

I recall the tough days of starting a career in observational astronomy after spending about two full years analyzing archival solar and stellar spectra. It all started with myself expressing my willingness to work on observational astronomy (those days at UPSO, observational astronomy means only doing optical observations, the perception of which gradually changed post 1997) to my Ph.D. thesis supervisor Prof. Ram Sagar. I was asked to go to the observing floor of the 104-cm and learn observations. I went to the observing floor with enthusiasm and expectations, but what I ended up doing on the first day of my training was completely different. When I went to the observing floor, I got introduced to Prof. E. S. R. Rajagopal, from the Indian Institute of Science (after his stint as Director of the National Physical Laboratory, New Delhi) and Dr. H. C. Kandpal from the National Physical Laboratory, New Delhi. I was explained by them that the experiment that was to be conducted on the said date was on optical interferometry. I could only recall a lid fixed to the telescope tube with two circular holes on it and a rope tied to one end of the lid. What I could understand at that time was that exposures need to be taken with the lid closed and the lid open. I was obediently following the commands from the control room for most of the night i.e. to pull the rope (the lid gets removed and the light enters the telescope tube) and (b) leave the rope (the lid closes the telescope tube and light falls on the detector through the two holes on the lid). The journey that started with the above observing run, followed up with some hard training at the ST has taken me to the place I am today.

UPSO was able to come out of the shadow of neglect, and gained recognition both nationally and internationally when it successfully carried out the optical afterglow observations of the GRB 990123, the first from Indian soil. Since then, UPSO has not looked back and continues to play a leading role in GRB observations from India, though such observations now do not carry the weight they had about two decades ago. Some of the observations were carried out in extremely handicapped situations forced by the dire financial state leading to non availability of electrical components and even diesel for operating the electricity generator in the event of

power failure. I had the opportunity to be associated with the afterglow observations of GRB 010022 and GRB 000301C. GRB 010022 was successfully observed on the night the GRB happened and on the following night, since it was cloudy no effort was made to observe the target. However, in deep sleep, I received a call on the intercom at around 1 am or so. The caller on the other end (Prof. Ram Sagar) was enquiring about the observations. I said "Sir, sky is cloudy and therefore I am sleeping", to which the reply was "…the sky is getting clear, observations will be possible…". As the message was loud and clear, I requested Dr. Rama Kant (then a student at UPSO) working late in the computer center (there were days when the computer center was open 24/7) to help me in filling liquid nitrogen. Those days we were trained to observe alone without any support. After filling liquid nitrogen and while waiting for the system to get stabilized we noticed that the drive system got burnt. We were handicapped for about 10 days as the motor coil was not available for immediate repair and there was no money to get it repaired outside UPSO. This was not the odd case, we had lost precious observing time, when there was no power and the generator could not be turned on due to a lack of diesel. Though the telescope was not in normal mode of operation, I was asked by Prof. Ram Sagar to observe the GRB the following day with the telescope being put on mains power and the observations carried out by manual guiding. Though difficult, it was very satisfying at the end, as that particular observation filled the important gap in the afterglow light curve. I am sure, students now at AIRES are spared of such difficult circumstances while they are observing.

The willingness of the institute to excel (as can be seen from one example mentioned above, and there are many more such examples), supported well by the dedicated technical staffs at the 104-cm ST and the hard work of all the students that time, catapulted UPSO from obscuration to prominence at the national level. More importantly, the decision to adopt "***flexible scheduling at the 104-cm***" was the key to success of the 104-cm telescope, as many key observational programs such as the "Nainital – Cape Survey", "the Andromeda Galaxy Lensing Experiment", "the Quasar Monitoring Programme", "the GRB follow-up" etc. were taken up. These programs yielded important results and have made an impact in the field and this impact is going to last forever. As the institute was gradually coming out of darkness, I also got the required training to do observational astronomy (as said earlier, at those days observational astronomy at UPSO meant only optical astronomy). I started to gather data for my own research topic which was on understanding the nature of quasar dichotomy with the guidance and help from Profs. Gopal-Krishna (NCRA, Pune), Ram Sagar and Paul J. Wiita (Georgia State University, Atlanta). To probe the scientific objective, we carried out a systemic investigation of the intra-night optical variability characteristics of a carefully selected sample of radio-loud and radio-quiet quasars using data from the 104-cm, amounting to more than 100 nights. Our observations indicated that the central engine of radio-loud and radio-quiet quasar may not be fundamentally different. This was the key result of the thesis, which would not have become possible without the generous telescope time (***in its flexible scheduling mode***) provided by UPSO. I am not aware of any such dedicated observing program currently being carried out at the 104-cm, except for the optical polarization program.

Irrespective of the severe hardships, the environment, the circumstances, the push to do hard work and the urge of the then UPSO to excel in the national scenario has yielded important observations from the 104-cm telescope. On this occasion of the 104-cm ST turning 50 years, I thank my thesis supervisors, the professors who taught me astronomy, the previous and current technical staff at the 104-cm facility. I wish the 104-cm ST many more successes in the future. My stint at UPSO, particularly my experiences with the 104-cm facility, I am sure, has taught me the following *"Hard Work beats talent, when talent does not work hard"* On the 50th year of the 104-cm ST, I am also happy to see that now ARIES has come out of its dark age (UPSO/SO) to the golden age to become a major player in ground based optical observational astronomy in the national and international scene.

Ground-based Infrared Astronomy at TIFR using ARIES facilities

D. K. Ojha
Tata Institute of Fundamental Research, Mumbai

The association of the TIFR near-infrared astronomy group with UPSO (later ARIES) extends to more than 35 years which commenced with InSb near-infrared photometer at the focal plane of the 104-cm Sampurnanand Optical Telescope. During 1987-1993, JHK observations of HZ Herculis, IRAS selected carbon stars and Be stars were carried out with the 104cm Sampurnanand Optical Telescope which resulted in many publications. This relationship has continued over the years and resulted in the latest near-infrared instruments TIRCAM2 and TANSPEC being mounted simultaneously on the side-port and main-port of the 3.6-meter Devasthal Optical Telescope, respectively. The 104-cm Sampurnanand Optical Telescope was instrumental in training many TIFR astronomy students in observational astronomy and this continues to this date.

Sampurnanand Telescope (ST), the crown of Manora Peak

Gopal Krishna
INSA Senior Scientist,
UM-DAE Centre for Excellence in Basic Sciences, Mumbai

I deeply appreciate the invitation to pen a few lines about my link to ST, on the historic occasion of its Golden Jubilee. My first exposure to this 104-cm telescope goes back to 1976 when I first came to Nainital to participate in a meeting of the Astronomical Society of India, which was hosted by UPSO under the stewardship of Prof. S. D. Sinvhal. Being a radio astronomer working on radio galaxies and quasars, little did I visualise that one day, ST would be playing a substantial role in my own research.

Historically, studies of stellar evolution, focused on star clusters, were the mainstay of UPSO research. In 1999, taking advantage of its geographical location, ST was pressed into monitoring afterglows of several cosmic gamma-ray bursts (GRB) and for a couple of years, this niche activity with ST made its mark internationally. Although, the use of ST for research on stellar evolution and active stars continues, it would be fair to say that from around the mid-1990s, until the advent of the 1.3m 'Devasthal Fast Optical Telescope' (DFOT) around 2010 (Sagar et al. 2011, Curr. Sci. 101, p.1020), the research output of UPSO/ARIES has been increasingly and very substantially contributed by the application of ST to the field of intra-night optical variability (INOV), covering blazars and several other major classes of active galactic nuclei (AGN). In this novel endeavour at UPSO, ST became the workhorse. INOV research at UPSO was launched by me around the mid-1990s, in collaboration with Prof. Ram Sagar, and this activity intensified after his moving to UPSO as its director, a few years later. We were joined by a few other colleagues from UPSO, more vigorously by the research scholars Mr. C. S. Stalin and Ms. Arti Goyal. I had the occasion to conceptualise and supervise their PhD projects and the bulk of their work was based on ST. The results were published in leading international journals, receiving 550 citations as of now. Since then, the sapling of INOV research at ARIES has blossomed into a mini-orchard and led to successful completion of about 10 PhD projects, with me in the role of 'instigator' and senior contributor in a majority of them. Even though observational input to these PhD projects after 2010 came increasingly from DFOT, ST has continued to be the 'trusted friend on call'. Today, when ST is completing 50 years, it can be asserted that the large body of research done at ARIES using ST has acquired an international footprint and thus ST is no longer an 'unsung hero'.

Working on a shoestring budget and virtually cut-off from the international astronomy community during its first few decades, UPSO and ST faced a big disadvantage, vis-a-vis similar facilities operating elsewhere in the country. While this handicap was partly made up due to the superior site of ST, I think that no less crucial was the grit and perseverance of the user community of ST. The living and working conditions prevailing at UPSO until the late 1990s can be (charitably) described as 'rough' and a far cry from the current situation at ARIES. The salutary role of ST was to keep the flame of science glowing at UPSO in those trying decades. Indeed, this was one motivating factor behind my research article, co-authored with S. Barve, titled "Discovery potential of small/medium-size optical telescopes: A study of publication patterns in NATURE

(1993-95)" (BASI, vol. 26, p.417, 1998). Therein we showed that it is only in the optical band that front-line astronomical research can be done even with small and medium size telescopes. Of course, the insight and wit of the user community are indispensable for attaining this seemingly impossible goal. To quote Pele, "The more difficult the victory, the greater is the happiness in winning". I wish ST a continued spell of internationally competitive science.

MEMOIRS

Dr Mahendra Singh

It is a proud moment for ARIES to celebrate the Golden Jubilee year of 104 cm Sampurnanand Telescope of ARIES, Nainital during 17 to 19 Oct, 2022. My congratulations to ARIES. The topic of the Workshop "The role of 1 meter class telescope in the modern Era is very significant. It was exactly 25 years ago when ARIES (the then UPSO) celebrated the Silver Jubilee of the 104 cm telescope during the same period in 1997. The topic of the workshop was nearly the same. It was the time when the requirement of having bigger telescope(s) of the 4 meter class for the Astronomical community was widely discussed. ARIES took the initiative and the installation of a 3.6meter telescope at Devasthal was successfully completed a few years back. The Devasthal 3.6m telescope is providing good results.

Some 60 Ph. D. theses were awarded and several hundred research papers were published from the observations taken from this 104 cm telescope during its 50 years long journey. My own Ph. D. thesis and most of the papers resulted from this telescope. This telescope has facilitated its services to every researcher from every part of the country and the world.

Thanks to all those dedicated scientists, engineers, technicians and support staff of the institute who have tendered their expert services in smooth functioning of the telescope and maintaining all the instruments attached with it.

Although I may not be there to witness the workshop as a participant, I wish everyone at ARIES all the best for a successful event. May this telescope complete another 50 years in its journey of providing services to researchers. I hope the outcome of the discussions and scientific deliberations during the workshop will open up new opportunities in new fields of astronomical research.

Dr Mahendra Singh
ARIES, Nainital
Email: msingh0721@gmail.com

A Journey…

Author: Dr. Nilakshi Veerabathina, Professor, U. of Texas at Arlington, USA
https://www.uta.edu/academics/faculty/profile?username=nilakshi

The purpose of writing this memoir is to convey the message of “keep on Keeping on” and to inspire everyone in their endeavors through the examples of my journey of beautiful experiences, hardships, and learning that I had at ARIES. I hope it serves the purpose and you find something inspiring on each page as you read through.

I grew up in Kurukshetra, a small, historical, and laid back town where clear skies were more of a norm than exception. Often in the summers, my friends and I spent evenings chatting and playing outdoors for hours, and my family in the nights slept on the roof under the open sky. Changing shapes of clouds, the site of the Moon, the twinkling stars, and some constellations that my father used to point at would capture my attention and take me to the world of imagination and questions. In the 6th grade, I visited a planetarium (Nehru Tarangan) for the first time ever when I went to Mumbai with my family for the holidays. For that one hour I was so completely engrossed in my thoughts watching the stars moving across the dark dome that I could not believe it was actually bright and sunny when we came out of the planetarium. In my 12th grade Physics book, I loved reading the last two chapters over and over that our teacher had told us to not study because nothing about stars, planets, or galaxies would be covered in the board exams. In the early college years, I followed the “Bharat Ek Khoj” television series that covered the history of India on Doordarshan (the only TV channel at that time). In one of the episodes, probably just for 10 seconds there was a scene in which a huge telescope dome opened, automatically rotated, and peeked at the sky. This was an awestruck moment for me. I envisioned myself standing in that dome near that telescope without even knowing where in the world such things existed or what I had to study to get there. I didn't even know if there were any people who study stars and space or colleges/universities that offer such courses. But lo! A few years later I completed my masters (M.Sc.) degree in Astronomy and Space Physics from Punjabi University and after that, I was standing in front of the massive dome of 104-cm Sampurnanand Telescope (second largest in India at that time) on the Manora Peak campus of ARIES (then Uttar Pradesh State Observatory, UPSO) where I got admitted in to the Ph.D. program as a junior research fellow (JRF) after a rigorous interview process. I joined ARIES in 1995 and spent the next most experiential six years of my life observing, exploring, and learning.

Here at ARIES under the supervision of scientist Dr. Ram Sagar, director of the institute at the time, my research work focused on the statistical study of the spatial distribution of stars in the rich galactic open star clusters. To study the core-corona structures of forty-three galactic clusters based on the radial density profiles I used the photometric data of Digitized Schmidt Survey (DSS) published in the U.S. Naval Observatory (USNO)_A V2.0 catalog. And for the in depth study of extended regions of two clusters, NGC7654 and NGC 2099, I obtained the CCD photometric data in UBVI filters from the 105 cm Kiso Schmidt prime focus telescope in Japan and 104 cm Sampurnanand Telescope in Nainital, respectively. The results of my study are published in my thesis and international journals in the form of research papers.

On the early morning of Jan 23rd, 1999, NASA's BATSE instrument on board the Compton Gamma Ray Space Observatory captured one of the brightest gamma ray bursts (GRB), an extremely energetic event of that time. It was also the first GRB for which a simultaneous optical flash was detected. The astronomers working in this field around the world were alerted. In the evening that day when I was prepping the Sampurnanand telescope with a fellow student for my observation night, I received a call from Dr. Sagar. He asked if I would be willing to dedicate part of my night for observing the gamma ray source for which he had been receiving information from one of his astronomer friends and collaborators in the USA. I agreed and we decided that after the GRB optical source rises, I would switch observations from my target cluster to this new object. Meanwhile, Dr. Sagar was continuously exchanging emails with the team in the USA to receive the refined coordinates to pinpoint the location of the object. Compton Gamma Ray Space Observatory used to indicate the possible location of the burst but not the exact location. Around midnight when it was time for the targeted GRB to rise at our location, Dr. Sagar and another scientist, Dr. A.K. Pandey arrived at the observation area. Right then we discovered that the Sampurnanand telescope’s auto tracker broke. We strategized the observations and decided Dr. Sagar and Dr. Pandey would take the control of the telescope and exposures from the control room, and I and the other student (Ramakant) would manually track the telescope. In the dark, cold, peaked winter night, in the open dome, on the top of the mountain, our jackets were not sufficient to keep us protected. To continue tracking through the night we had to grab blankets from the downstairs sleeping rooms and wrap ourselves around. As the night progressed the targeted object crossed the meridian and then started to set in the west. The position of the telescope moved downwards and at one point it became almost horizontal and the attached finderscope that we were using for manual tracking became almost unreachable. At one point the finderscope was so high that to reach it I was

standing on my tippy toes on the last rung of the mobile ladder platform. I would have fallen if I had moved even a few millimeters, but it was worth a risk. We all finished a successful night of observation. It was not the end of the story. Next day was Sunday morning. From the telescope dome we went directly to the computer center to calibrate the data. It was urgent to complete immediate image processing and calibration and send the results to our partners across the globe. There was no one else there in the computer room and the entire facility. Dr. Vijay Mohan who had joined us in the morning, Ramakant, and I worked until evening to get the results. There was no time for us to walk a long way down the hill to go to our dormitory to have food or get fresh and then walk back up. It was 24 hours without food and rest, but we made history as it was the first ever optical afterglow of a gamma ray burst observed from India and possibly Asia. The results of GRB 990123 (Jan 23rd 1999 Gamma Ray Burst) got published in several prestigious journals including Nature and Science. It is an excellent example of international collaboration and one of the greatest contributions of ARIES' Sampurnanand telescope to the world. ARIES became a pioneer in this field. Since then, several optical afterglows of gamma ray bursts have been observed from ARIES and it has become one of the prominent research fields at ARIES.

Our team (Dr. M. Singh, Dr. B.B. Sanwal, and Students) that observed the Leonid Meteor shower in 1998. This picture was included in a local newsletter.

The year 1998 brought back the Leonid meteor shower that repeats about every 33 years on the Earth. This meteor shower is caused by the interaction between Earth's atmosphere and the leftover debris from the comet Tempel-Tuttle. In November 1998, a group of us observed the shower but due to the presence of some thin clouds it wasn't spectacular. Still the local newspaper covered our story of meteors' observations. Came November 1999, again a peak time for the Leonid meteor shower to occur. This time the weather was clear and I did not want to miss the opportunity to observe and document the celestial fire show. I collected a group of four of my colleagues (research students) and planned the observations. We knew it was going to be naked eye observations because meteor showers were too fast to observe through a telescope. On the night of November 17/18 from midnight to 3 am in the morning, we observed the meteor shower from one of the topmost locations of ARIES, from where the entire sky was clearly visible, except for a small part in the

southern direction. It was an adequately dark night with the Moon in its first quarter phase. Our team was primed with papers, pens, and torches. (Note: cell phones and laptops did not exist and personal cameras were uncommon. None of us had any of these.) I planned the seating arrangement of our team in such a manner that one person was placed in the center, and the other four facing different directions to cover the entire sky. Around 1 am the heavenly show started that lasted for about two and a half hours. It was a thrilling experience of a cosmic show. There were cheers, oohs and aahs every time we noticed a shooting star falling. We noted down the directions, colors, brightnesses to our best abilities because none of us was expert or had much knowledge in this area of research. The most memorable was the greenish fireball that stayed in the sky for a few seconds instead of instantly diminishing like other meteors. Overall, we observed about 120 meteors in little over two hours. (On a side note, I also happened to observe the Leonid shower in 2002 and 2003 from Atlanta with several faculty and grad students of Georgia State University, where I had joined as an adjunct faculty at that time. The CNN news channel team was also with us to cover the event. But nothing could beat the cosmic show that we observed in 1999 from Nainital.) I collected our team's data, made charts, compared the brightnesses (apparent magnitudes) of meteors with that of the well known objects in the sky, such as Sirius, Venus, Polaris etc. and sent the paper to WGN, a bimonthly journal of the International Meteor Organization (IMO). It was the first time the international organization had received observation data of such an event from the South Eastern part of the world. They immediately accepted the paper even though it was not scientific as per their standards. Marc Gyssens, the editor-in-chief's comments for our paper were "It is very encouraging that the IMO receives more and more meteor observations from "less traditional " locations, improving the geographical distribution of the observations."

The other unforgettable astronomical events that happened during my time at ARIES were the total solar eclipse of 1995, appearance of comet Hale-Bopp in 1997, and occultation of Saturn by the Moon, also in 1997. My first experience of an astronomical phenomenon, the total solar eclipse, happened in Oct 1995, just a few months after I had joined ARIES. This eclipse was visible from across India. Some teams of

Left Photo: 15 cm Coude' Solar Telescope
Right photo: Me standing under its structure

scientists and students of ARIES were slated to visit the prime locations of totality in other cities, and some teams were to stay in ARIES. The team to which I belonged was chosen to stay on campus. We put a number of pinhole cameras and projection screens everywhere on ARIES grounds, and distributed eclipse glasses to hundreds of visitors and kids. People also observed the eclipse directly through the H-alpha filter of ARIES' 15 cm Coude' solar telescope. The totality of the eclipse was only 92% in the Nainital area, but it was still exciting to see the Sun gently getting eaten by the Moon's disc.

The comet Hale-Bopp was the most widely observed and one of the brightest comets of the 20th century. The most inspiring thing for me was the story of how two persons Alan Hale and Thomas Bopp discovered the comet separately but reported it to the Central Bureau for Astronomical Telegrams almost at the same time and hence were given the opportunity to name the comet in any way they wanted. I observed the comet's bluish-white tail grow taller everyday for a few days or probably weeks in late March and early April in 1997. It was a mesmerizing sight right from my office room's window and ARIES front lawns for a couple of hours every evening after the sunset. Everyday I impatiently waited for dusk to fall so that I could sight the comet. It got lower and lower in the western sky and finally went behind the low lying mountains and after a few weeks, I lost its sight but not the memories.

Red arrow indicates the location of my office room on the second floor from where I used to observe the comet.

Comet Hale-Bopp, 1997
Image credit: ESO/ E. Slawik

The phenomenon of occultation (hiding) of Saturn by the Moon happens about every 18 years. Fortunately, one such occultation cycle occurred during my stay at ARIES in Sept 1997. A couple of scientists, two or three other research students, and I observed it through the 10 inches refractor telescope. There were also many other people as the viewing of the

10 Inches refractor telescope used for public nights.

event was opened to the public. In the telescope's field of view, in the beginning the Saturn was about three fingers width away from the Moon. Every few minutes it got closer to the gibbous Moon. And then the outer edge of Saturn's ring kissed the Moon. After that Saturn slowly started to glide behind the Moon. A few minutes later most of Saturn's body and rings were behind the Moon except a tiny bit of the other side of the rings. Finally, Saturn hid completely behind the Moon for about an hour or so to slowly reappear from the other side. The phenomena was simple but complex, and vague but vivid.

Other than the outstanding astronomical events, there are so many things etched in my mind of those momentous days. Many times after working long hours of night in the observatory when I walked down the hill to go to my dorm, the tiredness just fled away greeted by the fresh breeze of wee hours, reddish glow of rising sun, the fields of pink and white wild (ILU) flowers, and glimpses of faintly glowing Himalayan peaks at the far distances. I also adored the public nights when we would give tours of ARIES facilities and telescopes to visitors of all ages who showed up. It always made me smile when people, especially kids, asked the same curious questions that I had when I was a kid. Their widened eyes and awestruck faces when they looked through the telescope are unforgettable.

White and pink wild flowers that cover the whole mountain in Spring. Locals call them Ilu (I Love You) flowers because of their beauty and eight petals structure.

The most memorable moments are the ones that I spent alone in reflection and contemplation. While preparing for the night observations, some evenings I would stand on the outside railing of the telescope dome looking at the vast, open, clear sky up but the rolling clouds below veiling the nearby towns in the valley. During the long exposure observations, I often ventured out in the night to get the glimpses of celestial beauty with my own eyes, which looked far more alive than the images coming on the computer screen in the control room. Sometimes when the observatory was closed and everybody left offices, I would sit on the steps of rose flowers patches in the front lawn of the main and new office buildings of

ARIES, wait for the evening staff to come to open certain rooms for us, absorb my eyes to appreciate the rose flowers of various colors that the staff gardner had planted carefully, listen the sounds of cicadas reverberating through the entire arena and sounds of the bells of Hanuman temple of adjacent mountain echoing through the atmosphere, observe the evening sky changing into beautiful night, and watch the snake like street lights of Nainital city start appearing in the far range.

Not all days were smooth and easy though. Staying on remote mountains holds numerous climatic hardships and challenges. The weather can change dramatically in no time. Sometimes there are heavy rains, earthquakes, landslides, lightning strikes, or snow storms and other times fires. Nowadays, most of us follow a weather app on our phones and stay prepared ahead of time for the upcoming weather conditions. That was not the possibility back then. One gorgeous looking winter night three of us research students were working in our office rooms and all of sudden power went out. Only then we realized there was a heavy snow storm and winds happening outside. When the storm subsided, in the cold darkness we ran through the piles of calf-high snow to get to our dormitory that was located where the residential campus was about 1 km down the hill. Once we reached the dorm, the only thing we had to give us warmth were our cooking stoves.

A snowy evening at ARIES, Manora Peak!

I remember one year on a weekend during fall months (Sept or Oct) when there were brown crumpled leaves of dry trees everywhere, a small fire started at the bottom of the eastern side of Manora peak. First the fire spread horizontally and then slowly started to crawl up. We knew that if not stopped it would burn on-campus housing and some science facilities located on that side of the mountain. Scientists and staff who lived on campus, their family members, and us the resident students all got into action. Within a few hours we calmed the fire by cautiously hitting the burning grasses with the stems of green trees. And in another year (May 1998), a strong hail storm hit the area. I was in my dorm room, the tennis-ball sized hails were falling in from the shattered windows and the wind gust was so strong that even with the full force I could not pull my room's door

open to go to the hallway. A couple of other students who somehow made it to the hallway, pushed my door from the other side and pulled me out. A major portion of the metal roof of our two storied dormitory was ripped apart and broken bricks of bare standing walls fell all over. In the dormitory, the downstairs had 7-8 students rooms and upstairs the guest rooms for national and international visitors. Luckily, there was no guest staying in at that time. There were many computers that were toppled from their desks in the computer center, shattered windows, and broken water tanks all over campus and Nainital city. It took several days for the electricity and other regular services to be restored. Fortunately, no fatalities or major human injuries were reported on campus, and all the main telescopes withstood the storm except the minor dents on the domes.

A scientist's house on-campus with broken windows, door, roof, and plaster from the hail storm (May 7th, 1998).

The other natural dangers were the wild animals and creatures. Particularly in the nights, we always tried to walk in small groups or pairs with flash lights. Some people even used fire lanterns to chase animals away in case of any encounter. For some reason I was never afraid of big animals, such as wild boars, wolves, or tigers (never encountered one). I was rather more scared of small creatures like snakes, bloodsucking leeches, scorpios, and lizards. Also, of the monkeys and langurs that most of the time peacefully hopped all around the mountain in their respective groups, but at certain times fought badly with each other.

There were many other hardships too as a student. For instance, in the beginning we had to cook our own food and that consumed a tremendous amount of our study time. When Dr. Sagar became the director, he understood the students' hardships and brought in many positive changes. A cook was hired to work in the dormitory to make food for students and the guest staying in the guest house. It

One pose with the cook (Bhairavnath ji)!

was a much better situation but still every student had to take turns to bring weekly groceries and keep track of inventory. Every week we used to load big sacks of groceries on the bus from Nainital city and unload when the bus reached campus. Sometimes we used to bring groceries and other essential stuff on foot. There was a lack of transportation. At that time, ARIES owned only one bus that used to run only twice a day on working days, once in the morning 7 am to bring off-campus employees from Nainital city and 5 pm in the evening to drop the day time employees back to Nainital and bring the night time staff. There was no bus service on weekends and holidays. We, basically, used to walk most times – sometimes several miles to go to Nainital or other places. Even to have lunch every day it used to take us about 15-20 minutes to walk down from our offices/computer-center to our dormitory and 20-25 min walk to climb back.

The blue dots indicate the distance (about 1 Km) between ARIES observatory to residential campus where director, scientists, and staff houses and students dormitory was located. Photo source: Google maps

Dormitory:
Downstairs students' rooms and upstairs guests' rooms.

There were no resources for enrichment - no television, cell phones, malls, shopping centers, or theme parks. Nearby city Nainital was many miles away. On

An excursion time with friends (fellow students and juniors)

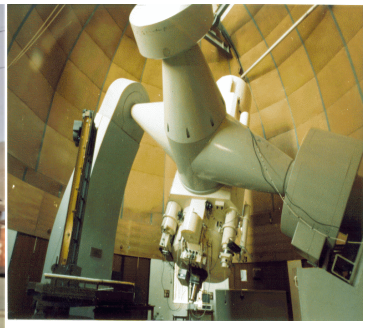
weekends and holidays our only entertainment used to be lazing around in the Sun, long hours of chit chatting with fellow students, strolling around the trees, visiting nearby temples or surrounding villages, going for lunch or dinner if get invited by on-campus scientists and staff families, very occasionally walk miles to watch a movie or local fair/carnival in Nainital. To bring in some celebration and recreation, I spearheaded a gathering once a year on Gandhi Jayanti holiday that included us (the Ph.D. students), faculty/staff and their families who lived on campus. I incorporated hurdle games, poem, dance, chess, and painting competitions in which everybody regardless of their rank from director, scientists, technical to lower rank staff and their kids participated. This became a tradition that everyone looked forward to since I started it in 1998. I hope the tradition continued even after I graduated, left ARIES, and moved to the USA.

Residential campus people and kids' gathering and competitions. In the picture on the right, we are focused and busy judging the performances (Oct 1998).

Our student group's circumstances were slightly unique in the sense that we did not have any senior students to learn from. All the previous students had graduated and then there was a little halt in between before ARIES brought in our batch of 4-5 students. We have to basically read those huge manuals and learn all the software, tools, and image processing steps ourselves and teach each other. Our supervisor scientists were extremely helpful, but being students we were often shy to ask for help for every small technical detail. When we presented the situation to the director, Dr. Sagar. He said when one cannot change circumstances, there are only two options: a) keep complaining or b) focus on

In the computer center, guiding to my juniors.

finding a solution. This is engraved in my mind ever since. Later, me and one or two other students made the simplified documents of essential commands and features of GNUPlot, DAOPHOT, MIDAS image processing and plotting tools and placed them in the computer center for our reference when needed, and also for the next batch of students so they do not have to go through big, bulky manuals and the frustration of learning. We used to spend most of our days in the computer center working on image processing, data reduction, analyzing, writing, and getting results to understand science.



Posing with the telescope's controls!

Long nights of working in the telescope building, carrying liquid nitrogen cylinder from first to second floor by stairs, detaching the CCD camera from the telescope, filling its dewar manually with the liquid nitrogen, and carefully attaching it back to the telescope was an arduous task. It was more challenging to handle liquid nitrogen in winters when outside and inside the dome temperatures were already very cold, but the fun part was that we all used to help each other during observation nights.

There were many personal hardships too. I used to travel 12 hours to get to the institute by changing multiple transportations. Being a young girl I was always super cautious during my travels. From Kurukshetra I would take an evening bus to the Inter State Bus Terminus (ISBT), Delhi, with a big backpack over my shoulder from there I would walk to the old Delhi Railway station and catch the night train (the only train available in those days) to Kathgodam, the last railway station before the mountains start. The train would reach Kathgodam at 4 am. In the dark dawn I would walk outside the railway station to catch a local bus to Nainital and from there the 7 am observatory bus to Manora Peak. If the observatory bus was missed or not in operation on that day, I would catch another local bus that would drop at the bottom of the Hanuman Garhi mountain and from there walk a couple of miles on a dirt road to reach the residential campus near Manora village. Once in the institute we were practically disconnected from the family. During the daytime on working days we could make phone calls from the main office, but in the evenings or during holidays, our only option was to make calls from the director's home which mostly stayed locked because of his

unavailability due to travels, or walk miles to Nainital to a STD (phone shop). There was an intercom facility available on campus, but that worked only for the incoming calls and that too only if a staff member was present to transfer calls from the main office. One year after my joining ARIES, unexpectedly my father passed away. In the beginning years I frequently traveled home, but as the research work increased, my frequency to travel decreased. It was emotionally draining at times to stay disconnected from family and childhood friends.

In the very beginning when I was not yet acclimated with the cold climate and learned the survival tactics of staying on mountains, I fell sick a couple of times. One of the professors suggested that my parents take me back home for good. I absolutely rejected the idea as I was determined to pursue Ph.D. for which I had come. I gave up my childhood habit of being picky food eater. Afterwards, I never cared about the taste of the food made by our cook. I would just eat it regardless of taste to stay healthy.

I spent many sleepless nights working on analyzing data in the computer center or making observations in the observatory. One of the most frustrating times was when my research work was on the peak during almost last year, and I learned that some of my data was corrupted as a cluster's images were highly aberrated. It was disheartening as I had to reject all that data and start over. It put my work months back. To finish my thesis, I spent the last three months completely in the computer center, from evenings to mornings when it used to be quiet without people and day hours I would go to the dorm to catch up on sleep.

When I joined ARIES, there were two girls. The other girl could not continue due to personal situations. One more girl joined in the later years of my stay, but she mainly stayed off campus (she is still at ARIES working as a scientist). There was no female scientist, engineer, or technical staff. There were a couple of female clerks in the main office, with whom our interaction was minimal. Practically, for the most part I was the only female in the entire observatory, which was at times extremely challenging. The students (my batch and the next), however, were friendly, respectful, and caring. The on-campus faculty/staff and their families were supportive and encouraging. Because of all of them I never felt isolated. Those relationships I have been and will forever value and cherish.

Looking back, these challenges, struggles, frustrations, hardships, and personal issues all seem mundane and insignificant against the much greater zeal of learning, scientific exploration, and internal quest. The hardships taught me resilience, helped me to grow stronger, rise above circumstances, and develop a

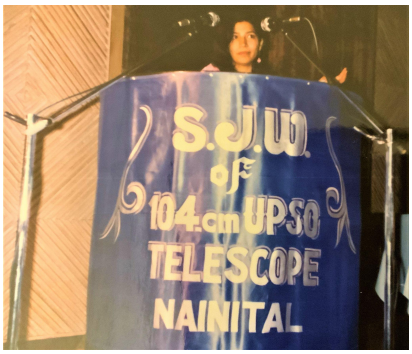
positive outlook towards life. That's the message now I want to pass on to the next generation. The external situations may slow us down for a little while, but cannot deter us if we are steadfastly determined towards our goal.

My farewell from ARIES

I completed and submitted my Ph.D. thesis to Kumaun University in 2001, defended it in 2002, and received the degree by mail in 2003. In 2004, Uttar Pradesh State Observatory (UPSO) under the state government became Aryabhatta Research Institute of Observational Sciences (ARIES) under the government of India.

This period (1998-2003) was important as in Oct 1997 we celebrated the 25-years Silver Jubilee of the Sampurnanand telescope and hosted the Young Astronomers Meet for the first time in Nainital in June 1999, and UPSO-IUCAA workshop on "Future of 2m Class Telescopes" in Oct 1999. And now exactly 25 years later, we are celebrating the 50 years Golden Jubilee. I am fortunate to get an opportunity to write my memoir for this grand celebration.

The Young Astronomers Meet (YAM) hosted first time in Nainital, June 1999.



Above photos are of 25-Years Golden Jubilee Celebration of the Sampurnanand Telescope, Apr 1997. In the group picture, there are two girls from ARIES in the center and two girls from Bangalore on the right side.

This period was also the transition period of paramount significance as the ARIES was in the making. Around the year 1998 it had become evident that the mountainous region of Uttar Pradesh was separating to become its own state. The future of UPSO was dim because the priorities of the government of the new state of Uttarakhand (now Uttranchal) that was on the horizon was to take care of the new state's and its people's basic needs, not the sciences. Dr. Sagar, UPSO's director, worked tirelessly for the survival of the observatory and sustaining its existence for the future. He traveled frequently to Delhi to have meetings with the members of the Department of Science and Technology of Government of India or Lucknow to meet with state's government officials. I used to wait days to catch him only for a few hours between his visits to discuss progress of my research work. When Dr. Sagar was in town, he along with other scientists and engineers would often visit Devasthal (a couple of hours away from Manora Peak) to sow the seeds of future research facilities. The work to study the site's climate and weather change, atmospheric stability, and presence of aerosols etc. started. Once I happened to visit Devasthal in the year 1999. There was only a small Lord Shiva temple (after which this place is called Devasthal) without a roof and

surrounded only by 2 or three feet temporary uncemented stone walls. There was only one constructed room for one or two scientists to stay overnight and a half built dome to bring in a 2 meter telescope in future. And today the Asia's largest telescope 3.6 meters Devasthal Optical Telescope (DOT) and 1.3 meter Devasthal Fast Optical Telescope (DFOT) proudly stand there. Today ARIES is one of the leading research institutes of India in the field of observational science and I am proud to be one of its almuna.

Shiva Temple, Devasthal, 1999

The journey was laborious and demanding but satisfying and fulfilling. Afterall, life is a continuous journey and we are merely a link but a significant one between preceding and succeeding generations. We are here for a much bigger purpose. Some seek it through spirituality and some through science, but both teach us we are all connected with a higher power or one may call it cosmos.

****

****

Congratulations to all the members, past and present, of ARIES on the 50-Year Golden Jubilee of the Sampurnanand telescope. I wish the current director, Dr. Dipankar Benerjee, scientists, engineers, staff, students, and collaborators the very best to take ARIES to greater heights and make it India's pride.

Thanks to all the people of ARIES who played a significant role during my stay, i.e. Dr. Ram Sagar, Dr. Vijay Mohan, late Dr. A.K. Pandey, Dr. Srivastav, Dr. S.K. Gupta, late Dr. Pitambar Pant, Dr. Wahab Uddin, Mr. Navin Kishor, many other staff and their families, and my friends (fellow students and juniors) Yogesh, Santosh, Alok D, Stalin, Ramakant, Brijesh, Shashibhushan, Jeewan, Snehlata, Karunakar, Girish, Tejbir, Alok C, and Ramesh. And most importantly my parents, husband, relatives, and childhood friends.

Paramjit Singh Goraya

Since childhood I was fascinated with stars and the moon that illuminated the night sky. By the time I completed my M. Sc. from Punjabi University Patiala in 1977, my passion for the celestial bodies had no bounds. In October 1978, this finally translated into reality when I joined as Scientific Assistant in UP State Observatory (UPSO) Nainital, (now known as ARIES), under the directorship of Dr. S. D. Sinvhal. This was the beginning of my scientific/academic career. I completed my Ph. D. under the guidance of Dr. S. C. Joshi, who introduced me to the field of 'Be Stars', which was the topic of my thesis.

The eight years (October1978-October 1986) spent at UPSO were the most incredible years of my life. The honesty and work ethic at the institution was unparalleled. I still cherish the beautiful experiences with my wonderful colleagues and treasure these memories. I often reminisce about the late night discussions/talks about comets with Dr. B. S. Rautela and B. B. Sanwal during the star studded, cold and chilly nights. The memories of the enjoyable time spent with Dr. U. S. Chaubey and Dr. M. Singh are still fresh in my mind and melt my heart. The help and support rendered by Dr. Vijay Mohan, Dr. Ram Sagar and Dr. U. C. Joshi at every stage fills my heart with gratitude and admiration. Dr L. M. Punetha's scientific and engineering bent of mind still intrigues me. The companionship of Dr N.M. Ashok (PRL, Ahmedabad) and Dr. A. K. Pandey reminds me of the golden times. Another colleague of mine whose company I cherished was Dr. Wahab Uddin, who was also an acquaintance during my initial days of hardship.

I recall our discussions and a shared dream about having a bigger telescope to be able to take our research to the next level. Back then, I was part of the initial proposal and discussions to realise this dream. I was elated to hear that our dream had been finally fulfilled with the installation of the 3.6m telescope at Devasthal, which is now Asia's biggest telescope. This instills me with immense joy and pride. I am extremely thankful to all those who have worked tirelessly over the years to make this dream a reality. Congratulations to the team at ARIES, and I wish that my fellow scientists are able to utilise this asset to take their work to greater heights.

History of ARIES: A premier research institute in the area of observational sciences

Ram Sagar
Indian Institute of Astrophysics, Bengaluru

(Excerpts from: Indian Journal of History of Science (2022) Vol 57 issue 3)

The Aryabhatta Research Institute of Observational Sciences (ARIES), a premier autonomous research institute under the Department of Science and Technology, Government of India has a legacy of about seven decades with contributions made in the field of observational sciences namely atmospheric and astrophysics. The Survey of India used a location at ARIES, determined with an accuracy of better than 10 meters on a world datum through the institute's participation in a global network of Earth artificial satellites imaging during the late 1950's. Taking advantage of its high-altitude location, ARIES, for the first time, provided valuable input for climate change studies by long term characterization of physical and chemical properties of aerosols and trace gases in the central Himalayan regions. In astrophysical sciences, the institute has contributed precise and sometimes unique observations of the celestial bodies leading to a number of discoveries. With the installation of the 3.6-m Devasthal optical telescope in the year 2015, India became the only Asian country to join those few nations of the world who are hosting 4-m class optical telescopes. This telescope, having advantage of geographical location, is well-suited for multi-wavelength observations and for sub-arc-second resolution imaging of the celestial objects including follow-up of the GMRT, AstroSat and gravitational-wave sources.

Idea of establishing an Observatory for the studies of celestial bodies was germinated about 7 decades ago jointly by Dr. Sampurnanand and Prof. A.N. Singh. Vision of Dr. M. K. Vainu Bappu, a doyen and father of optical astronomy in India, was to make it an international institution for studies of celestial objects and events. For this, the institute installed nine optical telescopes ranging in aperture size from 25-cm gravity driven refractor to 3.6-m modern actively supported DOT and 4-m ILMT. The 104-cm Sampurnanand telescope has achieved an important historical milestone of completing 50 golden years of its successful operation. Installation of optical telescopes at Devasthal, about 4 decades after installation of the 104-cm Sampurnanand telescope, has created important milestones in the history of both ARIES and Indian science. Active optics system of the 3.6-m DOT compensates for small distortions in the shape of the 4.3 tonne primary mirror due to gravity or atmospheric aberrations. Optical and NIR observations taken with the 3.6-m DOT reveal that performance of the telescope is at par with other similar global telescopes. Till its operation in the year 2016, the largest sized optical telescope in India was 2.34-m Vainu Bappu Telescope, inaugurated on January 6, 1986 by the then Prime Minister of India. Presently, the 1.04-m Sampurnanand telescope, 1.3-m DFOT and 3.6-m DOT are used for observations of different types of Galactic and extra-galactic objects including follow up observations of GMRT, AstroSat and gravitational wave sources. Their geographical location has global importance particularly for the time domain astrophysical studies.

The location of the Manora Peak in the CGH region is globally recognised for studies related to climate change. The atmospheric science laboratory of ARIES provides in situ physical and chemical measurements of trace gases and aerosols for detailed study of the physical, chemical and dynamical processes in the lower atmosphere of the CGH region. Space archival observations combined with fast optical imaging observations of solar transients and TSE taken with observational facilities of ARIES are used to study physical processes responsible for various solar activities during different solar cycles and for the coronal heating of the Sun.

Life at the First Point of ARIES

R.C. Kapoor
Indian Institute of Astrophysics, Bengaluru
Email: rckapoor@outlook.com, rck@iiap.res.in

We are all in the gutter, but some of us are looking at the stars.
- Oscar Wilde

The subject of astronomy fascinates us all. We not only wish to learn it as much as possible, we also want to share the joy it gives with one and all. All of us carry the germ. It goads us to look up and heed the call of the Event Horizon.

Me too, and here I am to share that joy with you. In my school days in the mid-1960s, I built a 2-inch refractor, the objective a plano-convex of 1-m focal length and the eyepiece a biconvex of 5 cm focal length. In my Inter- and undergraduate years at Gurukul Kangri, the library there offered a number of popular astronomy books in Hindi and English, by Gorakh Prasad, George Gamow and the like. The star charts therein enabled me to identify the constellations and the prominent stars, and with the telescope I enjoyed the beauty of the nebulae in Andromeda and in Orion, the Pleiades and the Praesepe, the Moon, the planets, etc. There were no interfering street-lights in my place of abode in Haridwar and I had a great time watching the Milky Way unaided. One early morning, the sungrazer Ikeya-Seki (C/1965 S1) with the tail occupying half the sky (it was ~60° long at maximum) offered an unforgettable sight. I believed I was an amateur astronomer.

In 1969, I joined KGK College at Moradabad for Masters in Physics. The Agra University offered a special paper in Astrophysics in the final year. I knew that the right place for it was Nainital, home to U.P. State Observatory (now ARIES) atop Manora Peak (*h*~1958m). So, when I cleared the first year, I approached the Department of Physics at the Thakur Dev Singh Bisht Govt. College, Nainital, also under Agra University. The Department Head Dr Khan said that there were only two approved seats and were occupied, while they also had one more candidate to take in. He directed me to the Observatory, saying that if they are ready, we can take you. That is where I met Dr M.C. Pande, a wonderful person. I told him of my interest and the books I had read. When I dropped the name Lawrence Aller, he asked me what is radiative equilibrium. I went blank, but seeing how keen I was, he signed his approval, saying if we are going to teach three, we can as well teach four students. We were taught the subject at the Observatory, theory and practical, twice a week. Dr S.D. Sinvhal was the Director in those days. After the results, I joined the UPSO in June 1971 as a *Shodh Parshad* (Research Scholar).

It was a wonderful campus with many observing houses, and flowering plants in front of the main building and along the approach road. There also was this tiny observatory with a 6-inch Carl Zeiss equatorial. The Observatory catered to the visitors on specific days who came over in a few numbers but also in droves. It was during the tourist season in May-June when the Campus saw them in large numbers. They were all shown around. Some of us would also step in and loved to show the visitors the sky and answer their questions. The Moon and Saturn were

great attractions whenever up in the sky. Even in the lean tourist period, there would be batches from schools visiting us. Sometimes, I would take people around, at times distinguished guests, to the telescope house of the 22-inch reflector or the 104-cm Zeiss telescope (now Sampurnanand Telescope) after it was installed in 1972. Their jaws would drop and some would exclaim – *science ne itni tarakki kar li* (Has Science progressed so much)? I still remember the anecdote, when a political leader had exclaimed at the time of the commissioning of the 22-inch reflector – *Ab is se India ke satellites chhode jayenge*. Conversing with the visitors affirmed the thought that we need to keep telling the people about the universe and how we are connected with it, life-long.

My stay at the Observatory was brief, till the end of February 1974, lasting a little less than three years. I was initially into observational astronomy – the flare stars. I carried out photoelectric surveillance of the flare stars with the 22-inch reflector, but also with the 104-cm telescope. With the latter, I also had a stint with some long exposure photography. Once I joined Dr S.C. Joshi and exposed the radio source 3C 373 [ICRS coord. (ep=J2000): 18 16 12.0 +31 22 00] at the Lyra-Hercules border to photographic plates for 2- and 3-hours. Reclining on the special rotatable trolley, one had to keep a constant watch through the accessorial telescope lest the object should drift away. The plates we exposed came out good but, how I wish I had taken a print of my maiden attempt. The 32/20-inch Baker-Nunn Camera installed in the Campus to track the American satellites came to be under my charge. The Observatory had bi-annual program to dis-assemble the telescopes, clean them up and then re-assemble with utmost care. In retrospect, my phase at the Observatory has been a great educational experience. With pleasure I note that the Observatory has made great progress ever since.

The Observatory is, in my career, the First Point of Aries. Life here was wonderful, with dreams galore. The atmosphere was congenial where I made good friends and got good guidance. The Staff was co-operative and treated us well. It is here that I got exposure to the exceptional flavour of the Kumaoni culture during the Holi festival – we would be invited to Dr Sinvhal's or Dr Pande's or the other seniors' homes in the campus. Spread over many nights, there would be night-long programs of music and poetry and endless food. That was also when the staff drivers would show off their latent talents – by taking possession of the harmonium and singing to the beats of the percussion instruments the songs of life. No words are enough to express my deep gratitude to my *Alma Mater Studiorum*.

The Past can't be Overridden

R.K. Srivastava
121 Basesment, Tallital Nainital - 263002 (U.K.)

Astronomy was initiated and installed in Uttar Pradesh primarily due to the cascading interest of ordain by Dr. Sampurnand, a strong believer of traditional culture.

It is important to glance at the etymology of U.P. State Observatory (UPSO, now ARIES), Nainital. It has three phases of development and research: primary phase (1954-1960), secondary phase (1960-1982) and tertiary phase (1982 till now). Up to 1963, 15cm refractor, 38cm reflector. 52cm reflector and 56cm reflector were possessed by UPSO.

The progress of older and modern activities began to fulfill and cherish the dreams of propagating Astronomy for the benefit of our country and abroad. In the early phase UPSO earned the name and fame by the following projects and researches.

A. 1 Optical Tracking of Artificial Earth Satellites
Sam Whiden installed the Baker-Nunn camera at UPSO and the first artificial earth satellite was recorded on 12 November, 1958. I joined this project on 4 November, 1963, when the snow was falling along with rains.

Among 12 tracking of artificial earth satellite stations around the globe, UPSO topped six times in a decade by securing the highest data of artificial earth satellites. UPSO not only earned the name and fame by this project but was benefited by the optics and optical instruments donated by the Smithsonian Astrophysical Observatory (SAO), USA. Several seniors were also a part of this project. Artificial Earth Satellite Observers experienced longest duties of 18 hours per 24 hours in those days.

2. Variable and Binary Star Research
In the early phase of UPSO, Dr. M.K. Vainu Bappu and others started observing solar eclipse, Mars observations, comets and photometric observations of celestial objects and variable stars. Dr. S.D. Sinvhal showed interest in eclipsing binaries. Around 1965 Binary Star Research picked up the momentum.

(i) I, along with my associates, started securing photometric observations of nearly two dozens of unknown and/ or little known binaries and analyzing their data, and the results were published either jointly or independently in reputed journals.

(ii) **New Features detected:** The new features were detected in the following:

(a) **AR Lacerate**: Flare-like Activity (3 paper published).
(b) **RW Com**: A possible three Body System (paper published).
(c) **Zeta Capricorni**: Disc System (paper published).
(d) **ST Persei**: A possible Multi – body System (paper published).

(iii) **Possible Variables:** Some eclipsing binaries and Stars were photometrically observed

and possibility of new –variability was detected:

(a) **CU Eridani**: a suspected variable (paper published).
(b) **Delta Cap**: a possible RSCVn Binary (paper published).
(c) **IZ Persei**: Contains a suspected Beta Canis Majoris type Variable (paper published).
(d) **Epsilon UMa**: a possible light variable (paper published).

3. Popularization of Astronomy

UPSO envisaged to create and generate interest in Astronomy among general public and students and to provide them with an attraction in gazing heavenly bodies. The author happened to be the in-charge of this program for about five years. For this purpose a 15cm refractor was used. Public and Students showed sizeable interest in this program. About one thousand visitors used to visit this program every night on the average. UPSO earned name and fame from this program.

B. Best Poster Paper Award

Art-crafted Poster Paper on Eclipsing Binary XY Ceti was prepared, which was rated best poster paper at the XI Meeting of the Astronomical Society of India held in 1986 at Bangalore. The UPSO was credited with a cash award of Rs. 100/-.

C. Other Researches

1. Spectrophotometric Observations

Spectrophotometric observations of AR Lacertae , Gamma Cassiopeiae, UX Arietis and V711Tau were secured and analyzed (papers published).

2. Infrared Observations

The 1-m telescope started functioning in October 1972. Infrared observations of HZ Hercules and of few unassociated IRAS sources with dust shells were secured and analysed (papers published).

3. Comet Observations

Observations of comet P/Halley and comet Swift–Turtle were secured and analysed (papers published).

4. Impact of SL-3 on Jupiter

Photoelectric Flash- light observations of SL-9 impact on Jupiter –a rare event – were secured and analyzed (paper published jointly).

D. Popular Articles

The following popular /scientific articles were prepared and published:
(i) Binaries Ballet
(ii) Universe at Large
(iii) Neglected Binaries of Special Importance.
(iv) Swing in Binary Research.
(v) Propagation and Popularization of Astronomy.

(vi) Sky Transparency at Nainital
(vii) Two others in Hindi.

E. Several other responsibilities were undertaken during the course of the author's long services of 37 years, 8 months, 29 days (including nearly two years of project service). About 70 research papers were published.

The work of a researcher can be judged on the following grounds:
(i) Number of publications in refereed journals.
(ii) Number of researchers, who quoted his work in their research.

Lastly, **Thomas Moore** had rightly imagined the essence of memory as under:-

"Long long be my heart with such memories fill'd!
Like the vase in which roses have once been distill'd:
You may break, you may shatter the vase if you will,
But the scent of the roses will hang round it still."

The modern technologies and encouragement to pure science are important to improve the quality of research yet good and amicable governance is necessary to conjunct these roses which are possessed with varied essences.

"Science is the highest form of Creative Art,
And, a scientist sees its beauty in Truth."

I pray to the Almighty to spread the glory of UPSO (now ARIES) round the globe under the able and amicable guidance of the present director.

Memorable associations with UPSO NainiTal

Seetha, S.

Members of then Technical Physics Division (TPD, now Space Astronomy Group) of ISRO Satellite Centre, Bangalore (now U.R. Rao Satellite Centre) were involved in conducting Photometry of variable stars from the early 1980s. The objects included flaring stars, optical counterparts of X-ray binaries and pulsating variables. Initially the observations were done at the 1m telescope at Kavalur, using cooled photomultiplier tubes connected to standard amplifiers and counter bins with a parallel printer.

During the IAU meeting in 1985 held in New Delhi we met J.E. Solheim and discussed the development of two channel photometer. This was primarily to isolate genuine variabilities and correct for terrestrial and instrumental effects. This idea fructified with our discussions with R.E. Nather and J.C. Clemens, who had developed a data acquisition system in the process of establishing a Whole Earth Telescope (Clemens, J.C., and Nather, R.E., 1987BAAS...19.1130C). This was essential to continuously monitor White Dwarf pulsators for a few days without daybreak in order to resolve the modes which could be present with a separation of few microHertz.

At TPD, we developed the first two channel photometer in 1987 and with an electronics card and Quilt software provided by the WET team, which could fit into the then recently available personal computers , we started having digitally recorded data. This helped to provide crucial observations from the critical longitude of India, for several white dwarf pulsators. The availability of uncooled, sensitive photomultiplier tubes made the system lighter and easier to handle (Rao, Venkat, G et al., BASI, 1990, 18, 79).

With the availability of the relatively light weight (photometer, desktop PC, terminal, is not light weight in the present scenario!), we decided to explore the opportunities of observing with other telescopes in the country starting with the 104cm Sampurnanand Telescope UPSO at NainiTal. The first time we went on a pilot trip we went all the way in train till Haldwani via Delhi and then by road with our instruments packed in wooden boxes. The three adventurers were T.M.K Marar, B.N. Ashoka and myself, and our collaborators from UPSO were B.C. Bhat, D.C Paliwal and A.K. Pandey, under the Directorship of Dr. M.C. Pandey and a lot of help from Prof. H.S. Mahra. We were at that time observing the short period binaries like AMCVn, and also cataclysmic variables particularly near the famous period gap.

We made extremely good observations starting in April, 1989 on both AMCVn and PG 1711+336 (see Seetha et al, and Ashoka et al., in Accretion powered compact binaries, ed. C.W. Mauche, Cambridge Univ. press, p 139, and p 243) With this success we requested for observing time of 1 week to 10 days mainly during April every year.

Instead of carrying the instrument everytime, we decided to make a photometer, which had become a 3 channel photometer with simultaneous observations of sky channel also, exclusively to be left at UPSO NainiTal which was operational from 1999. (Ashoka, B.N., et al., 2001, JApA...22..131A, Gupta, S.K. et al., 2001, BASI...29..479G). Meanwhile, UPSO had also

procured a CCD system for the telescope (Mohan, V et al., 1991BASI...19..235M). While long duration continuous photometry to detect variabilities was done with the 3 channel photometer, the CCD photometer was extremely productive for UBVRI photometry.

Meanwhile, D.W. Kurtz and Peter Martinez from SAAO realising the longitudinal aspect in India, proposed for initiating a survey of rapidly oscillating Ap stars using the same photometer, with collaboration with U.S. Chaubey and then Director Ramsagar. Under this a NainiTal Cape survey program was initiated in 1997. By then two students Girish. V at ISAC, and Santosh Joshi at UPSO had joined and they were initiated to conduct the observations. Several publications resulted from this collaboration (see above authors' list for the same, and for a summary Joshi, S. et al., 2006A&A...455..303J and references therein) and in addition to discovering roAp stars, UPSO was credited with the discovery of several Delta Scuti variables and has also contributed to observation runs of WET.

मेरी यादें

बहुत हर्ष एवं गर्व का विषय है कि एरीज दिनांक 17 अक्टूबर, 2022 को 104 सेंटीमीटर टेलीस्कोप की स्वर्ण जयंती मना रहा है।

मैं अप्रैल 1965 का वह दिन याद करता हूँ जब मैंने उत्तर प्रदेश राजकीय वेधशाला में टेक्नीशियन का कार्यभार संभाला था। मैं अपनी 41 वर्षो की लंबी सेवा अवधि पूर्ण करके 3 जून 2006 को एरीज से सेवानिवृत हुआ, इन 41 वर्षो की सेवा अवधि में संस्थान ने कई उतार चढ़ाव की परिस्थितियों का सामना करते हुए प्रगति की ओर अग्रसर होता रहा, जिसका श्रेय मैं भूतपूर्व निदेशक स्वर्गीय पद्मश्री डा0 एस0डी0 सीगवल को समर्पित करना चाहूंगा जिनके अथक प्रयास से बाधाओं का सामना करते हुए उत्तर प्रदेश राजकीय वेधशाला प्रगति की ओर अग्रसर होती गई और वर्तमान में एक ख्याति प्राप्त संस्थान है। इस संस्थान का इतिहास बहुत पुराना है। सर्वप्रथम यह राजकीय संस्कृत विद्यालय बनारस का एक हिस्सा थी, जो 1955 में बनारस से देवी लॉज नैनीताल में स्थानांतरित की गई। देवी लाज एक आवासीय परिसर था, जहाँ बनारस से आया समस्त सामान रखा गया। तत्पश्चात 20 नवम्बर 1961 को वेधशाला देवी लॉज से मनोरा पीक के नवनिर्मित भवन में स्थापित की गई।

वेधशाला का विधिवत उद्घाटन 16 जून 1962 को प्रो0 हुमायूं कबीर, (मिनिस्टर ऑफ सांइंटिफिक रिसर्च एंड कल्चरल अफेयर्स, गवर्नमेंट ऑफ इंडिया) द्वारा किया गया और मुख्य अतिथि के रुप में श्री सी0बी0 गुप्ता, (मुख्यमंत्री उत्तर प्रदेश) एवं डॉ0 सीताराम (मंत्री भारत सरकार) उपस्थित थे। 104–सेंटीमीटर टेलीस्कोप के आने से पूर्व वेधशाला के पास 15 सेंटीमीटर, 38 सेंटीमीटर, 52 सेंटीमीटर और 56 सेंटीमीटर की टेलीस्कोप थी, जिनका उपयोग वैज्ञानिकों के द्वारा शोध कार्य के लिए किया जाता था और वर्तमान में भी किया जा रहा है।

भूतपूर्व निदेशक डॉ0 एस0डी0 सीगवल के अथक प्रयासों द्वारा 104 सेंटीमीटर टेलीस्कोप को उत्तर प्रदेश शासन से स्वीकृति प्रदान हुई, जिसके लिए वेधशाला उनकी सदैव ऋणी रहेगी। 104 सेंटीमीटर टेलीस्कोप, Carl Zeiss ईस्ट जर्मनी द्वारा निर्मित की गई और 40 बॉक्सेस में पैक होकर सन 1969 में मनोरा पीक पहुँची। सन् 1971 में Carl Zeiss के इंजीनियर्स ने इस टेलीस्कोप को असेंबल करने का प्रयास किया तथा 11 फरवरी 1972 को वेधशाला को परीक्षण के लिए दे दिया गया।

7 जून 1973 को प्रो0 एम0जी0के0 मैनन (सचिव डिपार्टमेट ऑफ स्पेस) द्वारा मुख्य अतिथि माननीय राज्यपाल उत्तर प्रदेश और मंत्री श्री स्वामी शरण की उपस्थिति में स्वर्गीय डॉ0 संपूर्णानंद जी को समर्पित की गई।

अंत में मैं प्रो0 राम सागर भूतपूर्व निदेशक का आभार प्रकट करना चाहूँगा जिनके अथक प्रयास से वेधशाला एरीज (Autonomous body) के रुप में आया।

समस्त एरीज परिवार को स्वर्ण जयन्ती की हार्दिक शुभकामनाएँ।

आपका

सोहन लाल नौटियाल

भूतपूर्व इंजी0 एसि0– डी0

Fifty Golden year of 1.04 meter Sampurnanand Telescope

Umesh C. Joshi (Dr)
Professor (Retired)
Physical Research Laboratory, Ahmedabad

I am very happy to learn that Aryabhatta Research Institute of Observational Sciences (ARIES), formerly known as Uttar Pradesh State Observatory (UPSO) is celebrating the Golden Jubilee of the 104cm Sampurnanand Optical Telescope (ST) in October 2022. On this momentous occasion, I feel very honored to write a few lines on my association with the observatory and in particular with the ST. Thank you Astronomy Division ARIES for this invite.

I had a deep association with UPSO - my alma mater where I started my research career in astronomy/astrophysics. I did my masters degree from DSB College, Nainital. In the nal year (1970-71) , I along with three other students opted for a special paper "Astronomy/Astrophysics". We used to visit UPSO for the course work which was taught by a couple of scientists covering different topics. I am grateful to all my UPSO teachers who shaped my life. As Dr. S. D. Sinvhal was quite happy with my performance, he offered me a permanent position of Scientific Assistant immediately after the result was out. I joined UPSO in June 1971 and worked in different scientific positions until March 1982. Then I moved to the Physical research Laboratory, Ahmedabad.

Installation work of ST started in the second half of 1971 after the arrival of four engineers of Zeiss, Germany. They needed support from UPSO staff and Dr. S. D. Sinvhal, Director, allowed some people for this work. I was lucky to have participated in the installation work which continued until February 1972, followed by testing and validation work. The excitement related to installation work has always remained fresh in my mind. Telescope was dedicated to the community in June 1973 by Prof. MGK Menon. Since then the telescope remained the main workhorse of UPSO. By this time I had enough hands-on experience on other smaller telescopes (15, 20, and 22 inch) available with UPSO at that time and I was ready to take up observations on the newly installed ST. It was highly enjoyable observing on ST as compared to the other smaller telescopes mentioned above. A very helpful feature of ST was pointing the telescope to a star by just feeding its coordinates. Pointing accuracy of ST was quite good, saving a lot of time and effort.

In the second half of 1973, I started work on open star clusters for my PhD thesis under the guidance of Dr. S. D. Sinvhal. This was a totally new research field at that time in UPSO, observations of NGC1778 started in November 1973 using a photoelectric photometer attached to the Cassegrain focus of ST. NGC1778 was the first star cluster that was observed during November 1973 - January 1974 on ST. The results were presented in the first Astronomical Society Meeting in Osmania University, Hyderabad in February 1974 and later a paper was published in the journal "Pramana". Subsequently several other clusters were observed jointly with Dr. Rama Sagar and the photometric data obtained with ST were used for the study of clusters. Part of the data constituted my PhD thesis, and the degree was awarded in 1981 by Kumaun University. Several papers on the study of clusters were published in various journals. I

am very happy to say that the program "study in star clusters" turned out very successful as many scientists later received their PhD using observations on star clusters with ST.

In PRL I got involved in developing a high precision photo-polarimeter. After the laboratory test, the polarimeter was to be tested with a telescope. We applied for telescope time on ST, Dr. Sinvhal, the director, generously allotted telescope time. We had a couple of testing/observing runs of photo-polarimeter attached at the Cassegrain focus of ST. Many teething problems were sorted out during a couple of observing runs during 1985-90. In this respect we highly acknowledged the role of ST on the development of the PRL photo-polarimeter.

This is very satisfying that the ST remained very productive for the last 50 years, a remarkable feat for an instrument of this class. I wish the telescope will continue to contribute important observational discoveries in the years to come.

Picture Courtesy - Ritesh Patel
Compiled By - Virendra Yadav & Kuntal Misra