Work visit of an Indian colleague to Belgium
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Pallavi Sharaf (IIA, India; see picture) had the opportunity to visit Sophie Van Eck (ULB, Belgium) to engage in a collaborative research project focused on understanding the chemical evolution of heavy elements study specifically aimed at investigating the intermediate neutron-capture process (i-process) nucleosynthesis, which operates at a neutron density between the slow (s-) and rapid (r-) neutron-capture processes. The motivation behind this research was to explore the transitions between these nucleosynthetic pathways and their impact on the chemical composition of metal-poor stars.

During her visit, Pallavi Sharaf conducted a detailed spectroscopic analysis of a sample of Carbon-Enhanced Metal-Poor (CEMP) stars exhibiting mixed r- and s-process enrichment, commonly referred to as CEMP-r/s stars. Utilizing high-resolution spectroscopic data, she determined the abundances of neutron-capture elements, aiming to identify key signatures that differentiate contributions from the s-process, r-process, and i-process. This analysis was crucial in tracing the nucleosynthetic origins of these elements and understanding the astrophysical conditions under which they formed. The primary objective of this work was to derive precise elemental abundances and interpret their significance in the broader context of stellar nucleosynthesis and galactic chemical evolution.

Throughout her stay, Pallavi Sharaf gained valuable experience in abundance determination techniques, including comparing different spectral synthesis methods and assessing their reliability. Engaging in discussions with experts in the field, she explored the implications of their findings on the formation history and enrichment processes of CEMP-r/s stars. Recent research suggests that the abundance patterns observed in these stars may result from an interplay of multiple nucleosynthetic processes, with the i-process playing a significant role in shaping their chemical signatures, particularly in low-metallicity asymptotic giant branch (AGB) stars.

In addition to data analysis, they had in-depth discussions on various nucleosynthetic scenarios, modelling approaches, and strategies for handling large spectroscopic datasets. These discussions helped refine their interpretation of the abundance patterns and provided a more comprehensive understanding of the underlying physical mechanisms driving heavy-element formation. Every Monday, they also conducted scientific paper discussions and group meetings, critically evaluating recent advancements in the field and integrating new insights into their research framework.

Overall, this visit significantly strengthened the IIA-ULB collaboration, facilitating knowledge exchange and fostering new ideas for future research. The work conducted during this period contributed to the broader scientific effort of characterizing metal-poor stars and understanding their chemical evolution. By investigating the nucleosynthetic pathways that govern the production of heavy elements, this research provides valuable insights into the chemical enrichment history of the early universe and the astrophysical sites responsible for these processes.