

Thomas Metcalf SPD Travel Award Report

Solar Polarization Workshop 11
September 08-12, Prague, Czech Republic



Dr. Raveena Khan

Raveena is a Post Doctoral Researcher at the Indian Institute of Astrophysics in Bangalore. Her research focuses on numerical modeling of magnetically sensitive lines in the extreme-ultraviolet (EUV) spectrum along with the development and calibration of EUV instruments to probe the magnetic fields at the Sun's outermost layers. She is an early-career scientist working with the ISSI Team, "Models and Observations of the Middle Corona", led by Prof. Giulio Del Zanna and Dr. Matt West. During her Ph.D, she was selected as a Newkirk Fellow, as a result of which she pursued major part of her thesis at the High Altitude Observatory, Colorado, working under the mentorship of Dr. Sarah Gibson and Dr. Roberto Casini.

Oral contribution (Session 4):

EUV polarimetry of coronal E1 transition lines: Potential, Challenges & Future

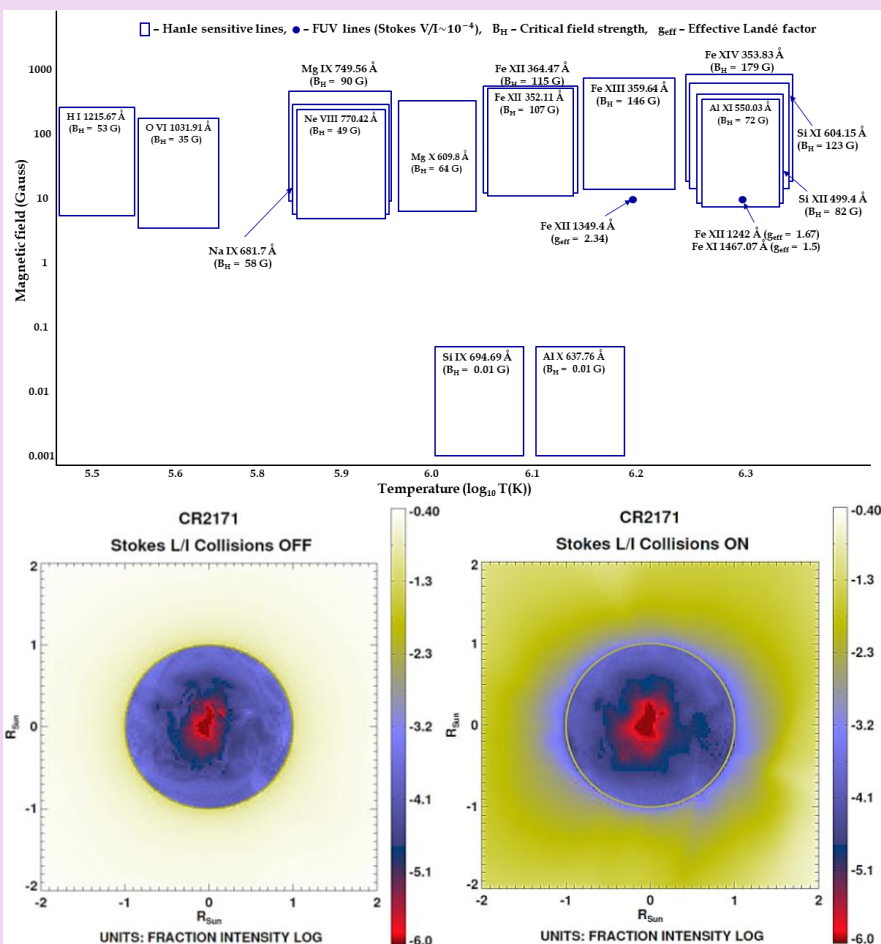
Sarah E. Gibson, Roberto Casini, K. Nagaraju

The solar corona is the outermost layer of the Sun where temperature exceeds 500,000 K, and radiates numerous emission lines in the extreme-ultraviolet (EUV) spectrum (Curdt et al. 2004). While coronal magnetism lies at the heart of many long-standing questions in solar physics, such as million-degree energization of the solar corona, initiation and acceleration of the solar wind, the lack of routine measurements of the vector magnetic field has limited our understanding of the occurrence of these physical processes in the corona.

In a series of studies exploring the potential and challenges of EUV polarimetry, we have identified several magnetically sensitive lines in the 100 to 1000 Å spectral range, which form at similar coronal plasma temperatures and lie close to each other in wavelength (*top figure*). However, to derive the coronal magnetic fields, we need to measure the observables – the linear polarization signals (Stokes I , Q , U) – which are sensitive to the magnetic fields via the Hanle effect. Therefore, in this work, we have synthesized scattering polarization for Ne VIII 770 Å (electric-dipole transition) line, examining how the polarization varies across different phases of a solar cycle under the influence of electron collisional excitation and magnetic fields.

We have investigated how collisions due to higher electron density in the lower corona can lead to depolarization (*bottom figure*) and hence, are very important to be accounted for, while interpreting the spectropolarimetric observations in the corona.

Similarly, there are other factors like Doppler dimming, which can affect the EUV polarization signals. The objective of our study has been to study the various effects on the spectral line polarization in the solar corona and disentangle their contribution from the effect of magnetic fields.



Top: Potential Hanle sensitive lines in EUV for probing the coronal magnetic fields (R. Khan and Nagaraju, 2022); **Bottom:** Synthesised polarization maps for the coronal plasma conditions as obtained from the 3D PSIMAS simulations (R. Khan et al. 2024).

I feel honoured and thankful to the AAS/SPD Metcalf Travel Award Committee and the Solar Polarization Workshop 11 SOC for choosing me as a Thomas Metcalf Travel Awardee. Participating in the Workshop at Prague helped me form collaborations, and deepen my knowledge while interacting with the experts in the field of spectropolarimetry.