

UNIVERSITY OF HERTFORDSHIRE  
CENTER FOR ASTROPHYSICS RESEARCH  
COLLEGE LANE  
HATFIELD AL10 9AB, UNITED KINGDOM

Dear Dr. Geach,

Please accept my application for the Innovation Fellow position in the “Astrosense” Project at the University of Hertfordshire.

I am currently a research associate with the Astrophysics Group at Imperial College London working in the field of NLTE radiative transfer. My work is concerned with the NLTE Spectral SYNthesis code (NESSY) development and its application to solar and stellar brightness variability modeling. It started back in 2011 when I graduated from the Astronomical Department of Saint Petersburg State University and commenced my PhD studies at Physical-Meteorological Observatory Davos, where the code had been used for solar irradiance calculations. The purpose of my project was to apply the code for understanding the connection between the UV and radio variabilities of the solar spectrum. In order to achieve this goal, the code had to be upgraded and tested. Hence, my PhD dissertation was naturally divided into three parts: code development, its verification and application.

The first part was devoted to upgrading the code’s NLTE block. NESSY was originally created for synthesizing the spectra emergent from Wolf-Rayet stars and its NLTE scheme was inefficient for the solar conditions, especially in the upper parts of the solar atmosphere where radio and UV radiation forms. After the upgrade the code became much faster, more reliable and applicable to both solar and stellar spectrum calculations. In the second part, I tested the code by comparing the center-to-limb variations of solar brightness calculated with it to the ones obtained from the solar eclipse observations by PREMOS instrument on-board the PICARD satellite. To this end, a procedure for extracting the center-to-limb variations from the eclipse observations was developed. Finally, in the third part, I applied NESSY together with HMI/SDO observations to model the solar variability in the UV and radio spectral domains and analyzed the correlation between them.

I published the results of the first part of my thesis in Astronomy & Astrophysics and defended my dissertation at ETH Zürich in the beginning of 2017. At that time I was already working at Imperial College, continuing to develop the code in collaboration with Dr. Yvonne Unruh to make it suitable for the so-called 1.5D solar and stellar variability calculations. In these calculations the advantages of 1D-NLTE radiative transfer are combined with the ability of the current 3D-MHD models to capture the dynamics of stellar interiors. I have made NESSY capable of switching between NLTE and LTE radiative transfer regimes for different chemical elements, and now I am working on merging the NLTE block of NESSY with the spectral synthesis block of the LTE radiative transfer code ATLAS9. The objective of these projects is to make NESSY fast enough to handle the computationally taxing 1.5D calculations. My work has been accompanied by teaching, which gives me an opportunity to explore other areas of physics, and by frequent collaboration visits to Max-Planck Institute for Solar System Research, where I contribute to the efforts of the ERC research group SOLVe (Connecting Solar and Stellar Variabilities) led by my former PhD supervisor Dr. Alexander Shapiro.

My current projects should be brought to completion by the end of the upcoming summer. I have been working in the field of stellar radiative transfer and variability for quite a long time and I am looking for an opportunity to apply myself in another area of astrophysics. As a specialist in NLTE stellar radiative transfer calculations I have some experience in using spectroscopic data sets, albeit not very large. That being said, I have acquired solid programming skills and I am always open to learn new ones, which makes me confident that I will be successful in expanding my data-handling abilities.

I look forward to discussing the Innovation Fellow position in the “Astrosense” project with you at an interview.

Sincerely,  
Rinat Tagirov