

NOVA Report for visit of Dr. Matthew Baring to API  
(by Dr. Matthew Baring)

Dates: 11 May, 2019 - 22 June, 2019

The objectives of the six-week visit of Prof. Baring to the Anton Pannekoek Institute (API) at the University of Amsterdam were two-fold:

- (i) To collaborate with Dr. Anna Watts on the modeling of hydrostatic structure of magnetar atmospheres;
- (ii) To interact with other API academics and visit four research institutions/universities to foster intellectual exchange in astronomy, anchored by the contribution of research colloquia under the auspices of NOVA.

The magnetar atmosphere work focused on setting up the derivation of force balance equations that are applicable for any position on a neutron star surface, not just at the magnetic pole where the magnetic field aligns with the zenith direction. This new generalization beyond previous expositions on magnetar hydrostatics is important because the determination of the vertical density/temperature structure is needed to inform detailed predictions of X-ray polarization from magnetars. An extensive literature search was performed, revealing a complete absence of treatments of atmospheres for arbitrary surface locations.

We started the exploration of key elements of the derivation, principally the incorporation of anisotropic gas pressures, and the contribution of the magnetic field to the force balance.

The visit was viewed from the outset as a start-up phase, and the work on this problem is ongoing.

The academic exchange visits to ASTRON, the Kapteyn Institute, Radboud University and SRON were all fruitful and rewarding experiences for all involved.