Doctoral Seminar

Graduate Research Training Group (GRK)

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INSTITUT FÜR PHYSIK

Talks in WiSe 2021

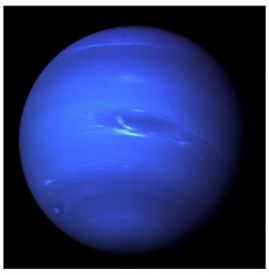
Traditio et Innovatio

Universität Rostock

4th November 2021, 3:00 pm
Ludwig Scheibe, Nadine Nettelmann, Ronald Redmer
Statistical Physics

Thermal Evolution of Uranus and Neptune – Influence of a deep thermal boundary layer

It has been a long-standing challenge to reconcile the perceived similarities of Uranus and Neptune with their highly different intrinsic heat fluxes. Previous evolution calculations using the conventional assumption of an adiabatic interior yield too high present-day luminosities or - equivalently – too long cooling times for Uranus.



For Neptune, we found that similar assumptions yield too short cooling times. One proposed mechanism for reproducing the observed brightness is a conducting thermal boundary layer between the hydrogen- and helium-rich outer part and the ice-rich inner part that would inhibit efficient energy transport across it. In this work, we use our recently developed tool for modelling giant planets to investigate such a boundary layer in the planet's interior. We find that even a thin thermal boundary layer of a few kilometres has significant influence on the planetary cooling. Initially, the presence of such an interface speeds up cooling, while after about 0.1-0.5 Gyr the cooling is slowed down drastically compared to the adiabatic case. Thus, the possibility of a thermal boundary layer allows for an explanation of both Uranus' and Neptune's luminosities within the same framework.

Talk: English
Slides: English
Location: Great Lecture Hall, HS1, Institute for Physics, Albert-Einstein Str. 24

Hybrid-Meeting: https://uni-rostock-de.zoom.us/j/67191822515?pwd=UTVJSXVPaDVLV0ZSZW9LR3NRVWF2UT09