

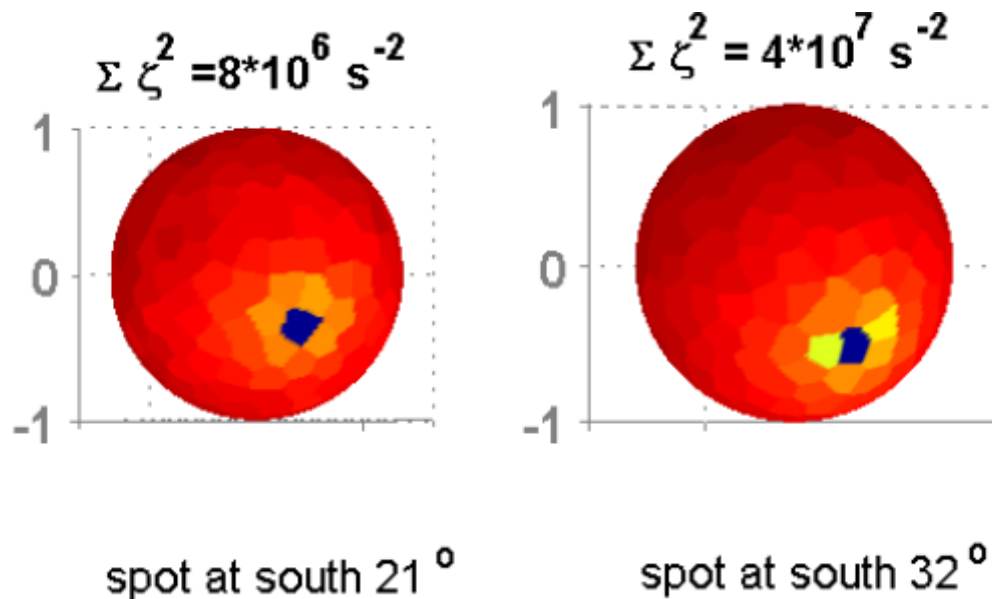
SENIOR RESEARCH PROJECT1

Title: Monte-Carlo Simulation and Data-mining

Supervisor: Prof Chjan Lim

Description: A large database on planetary atmospheres is available at NASA – in particular, the high rim velocity profile of the Great Red Spot is now documented in great detail. Parallel to that is an extensive dataset on the Jovian atmosphere generated at RPI by numerical simulations. Student projects include the downloading and analysis of NASA data and comparisons with the RPI dataset in relation to the internal velocity profile of the giant spots.

Outcome: Computer intensive projects are expected to find patterns in the NASA data that are relevant to the giant spots. One can start by looking for evidence of high rim velocities at the other coherent spots such as the Great White Ovals.



SENIOR RESEARCH PROJECT2

Title: Lagrangian Analysis and Rotational Fluid Dynamics

Supervisor: Prof Chjan Lim

Description: The role of centrifugal, centripetal and coriolis forces in fluids is an interesting multi-faceted area of research. Student projects that seek to understand this complex and dynamic topic in terms of basic Newtonian mechanics are available . A start can be made by reading and analyzing the canonical examples in chapter 3 of Feynman, Lectures in Physics Vol 1. The further understanding of the roles of energy, angular momentum and moments of inertia in the simple settings of rotating mass-springs systems will enable the student to move forward to continuous media such as rotating fluids.

Outcome: To start one should review classical mechanics – in particular the part that concerns Lagrangians and their Euler-Lagrange equations and their relation to Hamiltonian systems. Tools from Physics courses, Numerical computing, ODEs and PDEs can later be integrated with graphics and display functions in MATLAB to enhance the understanding and presentation of the simple mechanical systems expected to play a role in this project. A possible step is to build with departmental support, actual mass-springs systems on a rotating turn-table on which simple experiments for measuring the forces and accelerations in such systems can be attempted.