**Announcing the Final Examination of Jasmina Blecic for the Degree of Doctor of Philosophy in Physics**

**Date**: Friday, August 28, 2015
**Time**: 1:00 p.m.
**Room**: PSB 445
**Dissertation title**:
Observations, Thermochemical Calculations, and Modeling of Exoplanetary Atmospheres

**Abstract**:

This dissertation as a whole aims to provide the means to better understand hot-Jupiter planets through observing, performing thermochemical calculations, and modeling their atmospheres. We used *Spitzer* multi-wavelength secondary-eclipse observations to characterize planetary atmospheres. We chose targets with high signal-to-noise ratios, as their deep eclipses allow us to detect signatures of spectral features and assess planetary atmospheric structure and composition with greater certainty.

Chapter 1 gives a short introduction. Chapter 2 presents the *Spitzer* secondary-eclipse analysis and atmospheric characterization of WASP-14b. The decrease in flux when a planet passes behind its host star reveals the planet dayside thermal emission, which, in turn, tells us about the atmospheric temperature and pressure profiles and molecular abundances. WASP-14b is a highly irradiated, transiting hot Jupiter. By applying a Bayesian approach in the atmospheric analysis, we found an absence of thermal inversion contrary to theoretical predictions.

Chapter 3 describes the infrared observations of WASP-43b's *Spitzer* secondary eclipses, data analysis, and atmospheric characterization. WASP-43b is one of the closest-orbiting hot Jupiters, orbiting one of the coolest stars with a hot Jupiter. This configuration provided one of the strongest signal-to-noise ratios. The atmospheric analysis ruled out a strong thermal inversion in the dayside atmosphere of WASP-43b and put a nominal upper limit on the day-night energy redistribution.

Chapter 4 presents an open-source Thermochemical Equilibrium Abundances (TEA) code and its application to several hot-Jupiter temperature and pressure models. TEA calculates the abundances of gaseous molecular species using the Gibbs free-energy minimization method within an iterative Lagrangian optimization scheme. The thermochemical equilibrium abundances obtained with TEA can be used to initialize atmospheric models of any planetary atmosphere. The code is written in Python, in a modular fashion, and it is available to the community via *www.github.com/dzesmin/TEA*.

Chapter 5 presents my contributions to an open-source Bayesian Atmospheric Radiative Transfer (BART) code, and its application to WASP-43b. BART characterizes planetary atmospheres based on the observed spectroscopic information. It initializes a planetary atmospheric model, performs radiative-transfer calculations to produce models of planetary spectra, and using a statistical module compares models with observations. We describe the implementation of the initialization routines, the atmospheric profile generator, the eclipse module, the best-fit routines, and the contribution function module. We also present a comprehensive atmospheric analysis of all WASP-43b secondary-eclipse data obtained from the space- and ground-based observations using BART.

**Outline of Studies:**
Major: Physics – Planetary Sciences Track

**Educational Career:**
M. S. University of Belgrade, Serbia
B. S. University of Belgrade, Serbia

**Committee in Charge:**
Dr. Joseph Harrington (Chair)
Dr. Daniel Britt
Dr. Robert Peale
Dr. Jonathan Fortney (External Committee Member)

Approved for distribution by Dr. Joseph Harrington, on August 21, 2015.

The public is welcome to attend.