

# Long-Term Variability of the Broad H $\alpha$ and H $\beta$ Emission-Line Profiles of NGC 4151

D. Ilić<sup>1</sup>, A. I. Shapovalova<sup>2</sup>, L. Č. Popović<sup>3</sup>, A. N. Burenkov<sup>2</sup>,  
V. H. Chavushyan<sup>4</sup>, A. Kovačević<sup>1</sup>, N. G. Bochkarev<sup>5</sup>,  
and J. León-Tavares<sup>6</sup>

<sup>1</sup>Department of Astronomy, Faculty of Mathematics, University of Belgrade, Studentski trg 16,  
11000 Belgrade, Serbia

Email: dilic@matf.bg.ac.rs

<sup>2</sup>Special Astrophysical Observatory of the Russian AS, Nizhnij Arkhyz, Karachaevo-Cherkesia  
369167, Russia

<sup>3</sup>Astronomical Observatory, Volgina 7, 11160 Belgrade 74, Serbia

<sup>4</sup>Instituto Nacional de Astrofísica, Óptica y Electrónica, Apartado Postal 51, CP 72000,  
Puebla, Pue. México

<sup>5</sup>Sternberg Astronomical Institute, Moscow, Russia

<sup>6</sup>Metsähovi Radio Observatory, Helsinki University of Technology TKK, Metsähovintie 114,  
FIN-02540 Kylmälä, Finland

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In this work, we present the spectra of NGC 4151 observed over 11 years (from 1996 to 2006) using the SAO 6-m and 1-m telescopes (Russia), the GHAO 2.1-m telescope (Cananea, México), and the OAN-SPM 2.1-m telescope (San-Pedro, México). The procedure of spectra calibration is given by Shapovalova *et al.* (2008). Our analysis is focused on high-quality ( $S/N > 50$ ) spectra of the H $\alpha$  and H $\beta$  emission lines.

Analyzing the line profile variations of the H $\alpha$  and H $\beta$  lines, as well as the variations of different portions of their line profiles, we find that the line profiles are changing strongly during the monitoring period, showing blue and red asymmetries. They indicate a complex broad-line region (BLR) in NGC 4151, with at least three kinematically distinct regions: one that contributes to the blue wing, one to the core, and one to the red wing. Such variation can be caused by an accelerating outflow starting very close to the black hole, where the red part may come from the region very close to the black hole, while the blue part may come from the region having the highest outflow velocities. The outflow scenario correctly fits the responses of the different portions of the lines to the continuum. Taking into account the fact that the BLR of NGC 4151 has a complex geometry (probably affected by an outflow) and that a portion of the broad-line emission is not attributable to photoionization, one can ask the question whether a study by reverberation mapping of the BLR is valid in the case of this galaxy. For more details, see Shapovalova *et al.* (2008, 2009a,b).

## References

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