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Velocity Structure and Variability of [O III] Emission in Black Hole Host Globular Cluster RZ2109

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(Submitted on 20 Jul 2011)

We present a multi-facility study of the optical spectrum of the extragalactic globular cluster RZ2109, which hosts a bright black hole X-ray source. The optical spectrum of RZ2109 shows strong and very broad [O III]\lambda \lambda 4959,5007 emission in addition to the stellar absorption lines typical of a globular cluster. We use observations over an extended period of time to constrain the variability of these [O III] emission lines. We find that the equivalent width of the lines is similar in all of the datasets; the change in L[O III]\lambda 5007 is \ltsim 10% between the first and last observations, which were separated by 467 days. The velocity profile of the line also shows no significant variability over this interval. Using a simple geometric model we demonstrate that the observed [O III]\lambda 5007 line velocity structure can be described by a two component model with most of the flux contributed by a bipolar conical outflow of about 1,600 km/s, and the remainder from a Gaussian component with a FWHM of several hundred km/s.

Comments: 20 pages, 6 figures, 1 table. ApJ accepted
Subjects: **Galaxy Astrophysics (astro-ph.GA)**
Cite as: **arXiv:1107.4051 [astro-ph.GA]**
(or **arXiv:1107.4051v1 [astro-ph.GA]** for this version)

Submission history

From: Matthew Steele [view email]
[v1] Wed, 20 Jul 2011 18:09:09 GMT (178kb)

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