

## The First Light Curve Solutions and Period Study of BQ Ari<sup>1</sup>

© 2021 г. A. Poro<sup>1,2\*</sup>, F. Davoudi<sup>1,2</sup>, F. Alicavus<sup>3,4</sup>, S. Khakpash<sup>5</sup>,  
E. M. Esmer<sup>6</sup>, O. Basturk<sup>6</sup>, E. Lashgari<sup>1</sup>, J. Rahimi<sup>1</sup>, Y. Aladağ<sup>7</sup>,  
N. Aksaker<sup>7,8</sup>, A. Boudesh<sup>1</sup>, M. Ghanbarzadehchaeshtori<sup>1</sup>,  
A. Akyüz<sup>7,9</sup>, S. Modarres<sup>1</sup>, A. Sojoudizadeh<sup>1</sup>, M. Tekeş<sup>7</sup>, A. Solmaz<sup>10</sup>

<sup>1</sup>The International Occultation Timing Association Middle East section, Iran

<sup>2</sup>Astronomy Department of the Raderon Lab., Burnaby, BC, Canada

<sup>3</sup>Çanakkale Onsekiz Mart University, Faculty of Arts and Sciences, Department of Physics,  
17020, Çanakkale, Turkey

<sup>4</sup>Çanakkale Onsekiz Mart University, Astrophysics Research Center and Ulupınar Observatory,  
17020, Çanakkale, Turkey

<sup>5</sup>Department of Physics and Astronomy, University of Delaware, Newark, DE 19716, USA

<sup>6</sup>Ankara University, Faculty of Science, Astronomy and Space Sciences Department,  
TR-06100, Tandogan, Ankara, Turkey

<sup>7</sup>Space Science and Solar Energy Research and Application Center (UZAYMER), University of Çukurova,  
01330, Adana, Turkey

<sup>8</sup>Adana Organised Industrial Zones Vocational School of Technical Science, University of Çukurova,  
01410, Adana, Turkey

<sup>9</sup>Department of Physics, University of Çukurova,  
01330, Adana, Turkey

<sup>10</sup>Space Science and Solar Energy Research and Application Center (UZAYMER), University of Çukurova,  
01330, Adana, Turkey

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The first analysis of the photometric observation in BVR filters of a W UMa type binary system BQ Ari was performed. Light curve analysis was performed using Wilson–Devinney (W–D) code combined with a Monte Carlo (MC) simulation to determine its photometric and geometric elements and their uncertainties. These results show that BQ Ari is a contact binary system with a photometric mass ratio  $q = 0.548 \pm 0.019$ , a fillout factor  $f = 24 \pm 0.8\%$ , and an orbital inclination of  $i = 85.09 \pm 0.45$ . We used the parallax from Gaia EDR3 for calculating the absolute parameters of the binary system. This study suggested a new linear ephemeris for BQ Ari, combining our new mid-eclipse times and the previous observations, which we analyzed using the Monte Carlo Markov Chain (MCMC) method. We present the first analysis of the system's orbital period behavior by analyzing the O–C diagram using the Genetic Algorithm (GA) and the MCMC approaches in OCFit code. We attempted to explain the analysis of the residuals of linear fit in the O–C diagram with two approaches; “LiTE + Quadratic” and “Magnetic activity + Quadratic.” Although we consider the magnetic activity to be probable, the system should be studied further in order to reveal the nature of orbital period variations.

*Keywords:* Techniques: photometric; Stars: binaries: eclipsing; Stars: individual: BQ Ari.

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\*E-mail: [iotamiddleeast@yahoo.com](mailto:iotamiddleeast@yahoo.com), [info@iota-me.com](mailto:info@iota-me.com)