Orbital Determination of Mars-Crossing Asteroid 1988 DZ4 via Computational Method of Gauss

Stargrada Familia
SSP 2020 Astrophysics, New Mexico Tech

July 25, 2020

Team members:	Fiona Luo
	Alesya Dewland
	Nick Walker
Academic Director:	Dr. A. Rengstorf
Associate Director:	Dr. W. Anderson

Abstract

In our research surrounding the determination of the orbit of asteroid 1988 DZ4 (10737 Brück), our computations produced values that describe the six classical orbital elements, commonly referred to as the Keplerian elements. Such parameters allow us to precisely map the trajectory of the asteroid, predict its position at any point in time, and visualize the properties of the orbit. In order to calculate the final orbital elements, we first conducted remote observations, taking advantage of multiple telescopes across the United States, and subsequently processed the images in order to determine the right ascension (α) and declination (δ) using automatic computational astrometry. After gathering four nights' worth of data, we ran three sets of α and δ values through our orbit determination Python code, arriving at the preliminary orbital elements. After constructing an iterative Monte Carlo solution for the orbital elements and running sequences of 100,000 iterations, we were presented with our final orbital elements and their respective standard deviations, which followed approximately normal Gaussian distributions. From these results, we generated ephemerides to confirm that our computed orbital elements resulted in α and δ values comparable to those that we found in our astrometric analysis and that our values fell within the expected range of error. Observational data in this research is published in the Minor Planet Circulars by the Minor Planet Center, at the Smithsonian Astrophysical Observatory in Cambridge, MA.