

Searching for Habitable Worlds Using Artificial Intelligence

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Detecting habitable worlds around nearby stars and searching for life among them is one of the main goals of science. However, it is extremely challenging to detect them with the ground-based Doppler spectroscopy and space-based transit photometry as their signals are extremely weak. We launched the Dharma Planet Survey (DPS) using the TOU very high precision Doppler spectrograph at the fully dedicated 50-inch Automatic Dharma Endowment Foundation Telescope (DEFT) on Mt. Lemmon in 2016 to search for habitable planets around nearby FGKM dwarfs. To date, more than 80 survey targets have been observed with more than 10 times each. Seven low-mass planet candidates have been detected. In the meantime, we are developing deep neural networks to capture weak long-period transit signals from habitable Earth-like planets in the Kepler photometry data, taking advantage of the newly established NSF deep learning (DL) center at UF. An early DL model was able to detect over 20,000 weak metal absorption lines among SDSS 50,000 quasar spectra at better than 90% accuracy in an extremely short time (20 sec). This DL method is being implemented in Kepler data and will be implemented in DPS spectroscopy data to significantly boost search speed to detect weak habitable planet signals and optimize DPS operation efficiency. Early results will be presented.

Dr. Ge is a professor of astronomy at University of Florida (2004-present). He was an assistant professor at Pennsylvania State University in 2000-2004, and a postdoc research staff at Lawrence Livermore National Lab in 1998-2000. He got his Ph.D in Astronomy at the University of Arizona in 1998 and his BSc at University of Science and Technology of China in 1989.

He is the Principal Investigator of the Dharma Planet Survey and a collaborator of the NASA TESS mission. He was the PI for the MARVELS survey of the SDSS-III program in 2008-2014, the PI for the TOU, EXPERT, LiJET, and W.M. Keck Exoplanet Tracker optical Doppler instruments and also FIRST near IR Doppler instrument. He led the development of dispersed fixed-delay interferometry for both single and multiple object Doppler spectroscopy and the first silicon grisms and large format silicon immersion gratings. He also led the development of the advanced image slicer integral field optics, and new generation coronagraphic image and pupil masks for NASA Terrestrial Planet Finder (TPF). His team discovered three new planets (confirmed two transiting planets), 16 brown dwarfs and over 400 new binaries, about 700 high redshift quasar 2175 Å dust absorbers, a new population of quasar absorber, and molecular hydrogen in four high-redshift damped Lyman alpha quasar absorbers, and measured high redshift Cosmic Microwave Background Radiation temperatures. He has published over 300 refereed journal and technical papers, and abstracts.

