



SACHU SANJAYAN

Design Science, Stellar Astronomy, and Planetary Science
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INTRO

I am a 3D Artist, Astronomer, and Data Scientist. I am a doctoral student at Nicolaus Copernicus Astronomical Center (CAMK) in Warsaw, Poland. I am doing my research in stellar astrophysics using asteroseismology, modeling of variable stars from Kepler space observations. My work focuses on understanding the evolution of old open clusters using stellar modeling of different genres of variable stars. I have a venture for designing scientific visualizations and web applications in the field of science. I am passionate about 3D Art, Design science, Illustrations, Open Source Art tools, and Astrophotography. As a data scientist, I love working with big multi-dimensional data and revealing underlying trends and anomalies. In the past, I worked with MRI data to study the correlation between brain function and actions in humans. I used terrain data for planetary science projects on Mars and Moon using algorithms to detect craters and other surface features. Currently, I am working with Kepler, TESS, and GAIA space mission data, using methods such as time series analysis, advanced statistical methods, and machine learning applications. I am the founder of Spacentity - a platform where I experiment with the design elements for combining science and art.

"I believe that there is interconnectedness between art and science."

CURRENT

Since 2018

- 4th year Ph.D. student, [Nicolaus Copernicus Astronomical Center \(CAMK\)](#), Warsaw, Poland.
- Researcher and data scientist, [Ardastella Research Group](#), Krakow, Poland.

PhD PROJECT

Title : Understanding stellar dynamics and evolution of oldest open clusters from variable star observations using modeling.

Supervisors : Prof. Andrzej Baran - Pedagogical University, Krakow; Prof. Gerald Handler - CAMK, Warsaw

Description : The goal of our project is to understand the different channels of stellar evolution in variable stars and understand how they differ from field stars in dense cluster environments. We searched for variable stars in the field of two old open clusters NGC 6791 and NGC 6819 observed by the Kepler mission and discovered many variable targets. We determined the membership probabilities of each variable target using Gaia data and derived average cluster parameters from the members. We classified them based on the variability and position in the color-magnitude diagram. Then We modeled some of these variable targets such as hot subdwarf B star pulsators to derive cluster properties independently.

EDUCATION

Integrated Masters in Physics 2016

ALMA MATER - [Indian Institute of Science Education and Research](#), Kolkata, India

Masters Thesis - [A study of Stellar Dynamics - Theory and Simulations](#)

Higher Secondary Education - 2011

Govt. Model Boys School, Kerala, 95%.

High School Education - 2009

Amritha Vidhya Peetham, Kerala, 98%

PROFESSIONAL SKILLS

Blender3D - Extensive experience in 3D visualizations.

Designing & Illustration - Certification of Linkdin Design path. Skills in Photoshop, Gimp, and Illustrator.

Python - Extensively experienced in python (Numpy, Pandas, Scipy, Flask, Jinja, Astropy)

Matlab - Moderate experience in Matlab and Octave

HTML - CSS - Bootstrap - Moderate knowledge of web applications and development

Data Visualization - Using Matplotlib, Bokeh, and Plotly

Machine learning - Certification in data science and machine learning (Udemy), Python Scikit-learn & Tensor flow.

Flask - Jinja - Basic knowledge of static and dynamic web applications

Fortran & C - Basic knowledge

Unity & C# - Moderate experience in creating and scripting worlds in unity.

Operating systems - Microsoft and Linux

Astronomy tools

Lightcurve - Kepler, TESS lightcurve processing in Python

Phoebe - Binary star modeling package in python

MIST - MESA Isochrones and stellar tracks

CREATIVE SKILLS

DIY Project : [Mobile Microscope - Mew scope\(2017\)](#), VR Hologram

Documentaries : [Mirrors of Mind](#), [Childhood](#), and World of Termites

Designing scientific concepts using art tools - [Spacentity](#)

INTERESTS

Environment Design : Designing environments using 3d art tools.

Game Designing : Developing scientific games for a better learning experience.

Scientific Visualizations : Creating scientific visualizations for underlying concepts.

Exoplanets : Implying direct and indirect methods to find harboring exoplanets.

Planetary science : Exploring the exoplanets in the Goldilocks zone.

CORE ABILITIES

Undertake tasks to completion within the timeline of the project.

Social communication skills with the team and clients in fluent English.

Creative thinking for visualizing problems and solving them in smarter ways.

Open to learning new interesting fields.

Ability to creatively link multiple disciplines to make smart bridges.

A team player with personal reflection.

Opposition thinking to ensure positive outcomes.

EXPERIENCE

Since 2018 : Data analysis and visualizations

[Ardatsella Research Group](#), Krakow.

Analysis and processing of Kepler data of open clusters NGC 6791 and NGC 6819

Prof. Andrzej Baran, Professor, Uniwersytet Pedagogiczny w Krakowie

Details:

Developing modules for searching variable stars.

Time series analysis and processing of light curves.

Prewhitening and frequency extraction tools development in Python3.

Improving midtime estimations in eclipsing systems using modified kwee methods.

Developing modules for third body detection in eclipsing systems.

Deploying web applications for data processing and visualization.

2017 - 2018 : Researcher and Data analyst

[National Geophysical Research Institute](#), Hyderabad.

Earth Observation using Radar interferometry data from satellites using Sentinel Application Platform.

Dr.V.M.Tiwari, Director, National Geophysical Research Institute, Hyderabad

2016 - 2017 : Researcher

[Institute of Science Education and Research](#), Kolkata.

Martian crater planetary science data using correlation and wavelet studies.

Prof.P.K.Panigrahi, Professor, IISER Kolkata

2015 : Project Fellow

Indian Institute of Science Education and Research, Kolkata

Crater detection algorithms (CDA) for detecting craters and their properties on Mars and Moon.

Prof.P.K.Panigrahi, Professor, IISER Kolkata

2015 : Research Project

Indian Institute of Science Education and Research, Kolkata

[Study of stellar structures using Tolman Oppenheimer Volkoff equation](#)

Dr.R.K.Nayak, Associate Professor, IISER Kolkata

2015 : Research Project

Indian Institute of Science Education and Research, Kolkata

Correlation studies on functional MRI data

Dr. Pei Liang, Visiting Professor, IISER Kolkata

2014 - 2016 : Master Project

Indian Institute of Science Education and Research, Kolkata

[Study of Dynamics of stellar systems \(Globular cluster Evolution\), Modeling and Simulation](#)

Dr. R. K. Nayak, Associate Professor, IISER Kolkata

2014 : Project

Indian Institute of Science Education and Research, Kolkata

Simulations of optimal conditions on Laser Interferometer Gravitational Observatory (LIGO)

Dr. R. K. Nayak, Associate Professor, IISER Kolkata

2014 : Research Project

Indian Institute of Science Education and Research, Kolkata

Presentation on how Mirror neurons link between Action, Observation, and Social skills

TALKS & CONFERENCES

2019 - Jun : Conference

9th Meeting on Hot Subdwarfs and Related Objects, Hendaye, France

On Musical orchestra of pulsating subdwarf B stars in NGC 6791

2019 - Jun : Conference

The first conference of young researchers, CAMK, Warsaw

On Musical orchestra of pulsating subdwarf B stars in NGC 6791

2020 - Jan : Public outreach

Night under the stars, Astronomical Observatory of the Jagiellonian University, Krakow

Astrophotography and variable star observations using DSLRs and mobile devices

2020 - Jun : Zoom-Conference

The Second conference of young researchers, CAMK, Warsaw

On evolutionary modeling of subdwarf B stars in the oldest open cluster NGC 6791

2021 - Jun : Zoom-Seminar

Annual PhD seminar, CAMK, Warsaw

Search for variable stars in the oldest open cluster NGC 6791

AWARDS & ACHIEVEMENTS

2018 : Selected for a doctoral program in Nicolaus Copernicus Astronomical Center, Warsaw, Poland.

2017 : Inspire fellowship for Doctoral program, India

2014 : First Prize in 4R-Documentary Event-Pravega at Indian Institute of Science, Bangalore

2011 : Inspire Fellowship for 5-year integrated Masters Program, India.

2009 : Award for maximum scores in all subjects, India.

PUBLICATIONS

- [1] S. Sanjayan, A. S. Baran, J. Ostrowski, P. Németh, I. Pelisoli, R. Østensen, J. W.Kern, M. D. Reed, and S. K. Sahoo. [Pulsating subdwarf B stars in the oldest open cluster NGC 6791](#), MNRAS, 509(1):763–777, January 2022
- [2] S. Sanjayan, A. S. Baran, K. Kinemuchi, P. Németh, J. Ostrowski, and S. K. Sahoo. A variable star population in the open cluster NGC 6791 observed by the Kepler spacecraft, ACTA : (status : Under review), May 2022
- [3] A. S. Baran, S. K. Sahoo, S. Sanjayan, and J. Ostrowski. [A search for variable subdwarf B stars in TESS Full Frame Images II. Variable objects in the northern ecliptic hemisphere](#), MNRAS, 503(3):3828-3847, May 2021
- [4] J. Ostrowski, A. S. Baran, S. Sanjayan, and S. K. Sahoo. [Evolutionary modeling of subdwarf B stars using MESA with the predictive mixing and convective pre-mixing schemes](#), 503(3):4646–4661, May 2021.
- [5] S. K. Sahoo, A. S. Baran, S. Sanjayan, and J. Ostrowski. [A search for variable subdwarf B stars in TESS full frame images - I. Variable objects in the southern ecliptic hemisphere](#), MNRAS, 499(4):5508–5526, December 2020.
- [6] A. S. Baran, R. H. Østensen, U. Heber, A. Irrgang, S. Sanjayan, J. H. Telting, M. D.Reed, and J. Ostrowski. [Space observations of AA Doradus provide consistent mass determinations](#), New HW-Vir systems observed with TESS, MNRAS, 503(2):2157–2167, May 2021.
- [7] S. K. Sahoo, A. S. Baran, U. Heber, J. Ostrowski, S. Sanjayan, R. Silvotti, A. Irrgang, M. Uzundag, M. D. Reed, K. A. Shoaf, R. Raddi, M. Vuckovic, H. Ghasemi, W. Zong, and K. J. Bell. [Mode identification in three pulsating hot subdwarfs observed with TESS satellite](#), MNRAS, 495(3):2844–2857, January 2020.
- [8] M. D. Reed, A. Slayton, A. S. Baran, J. H. Telting, R. H. Østensen, C. S. Jeffery, M. Uzundag, and S. Sanjayan. [Pulsating subdwarf B stars observed with K2 during Campaign 7 and an examination of seismic group properties](#), MNRAS, 507(3):4178–4195, November 2021.

REFERENCES

Prof. Andrzej Baran
 (Ph.D. supervisor) Professor
 Uniwersytet Pedagogiczny w Krakowie, Kraków
andrzej.baran@up.krakow.pl

[Dr. Rajesh Kumble Nayak](#)
 (MS Thesis supervisor)
 Department of Physics, IISER Kolkata
rajesh@iiserkol.ac.in

DECLARATION

I consent to the processing of my personal data contained in my application for the needs of the recruitment process (In accordance with the Act of 29 August 1997 on the protection of personal data, consolidated text: Journal of Laws of 2016, item 922).