Problem and Users

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Project Overview

- Objective: Develop a system to manage and analyze binary star data
- Key Features:
  - Import multivariable time-series simulation data into relational database
  - Provide sample SQL queries
  - Enable custom queries through natural language processing
- Deliverables:
  - Relational database
  - User Interface for writing and viewing SQL queries
  - Sample SQL queries

Context

- POSYDON : POpulation SYnthesis with Detailed binary-evolution simulatiONs
- Developed by a collaborative group of scientists primarily at Northwestern University
- Simulates stellar evolution of binary stars
- Generates large amount of data as simulation output
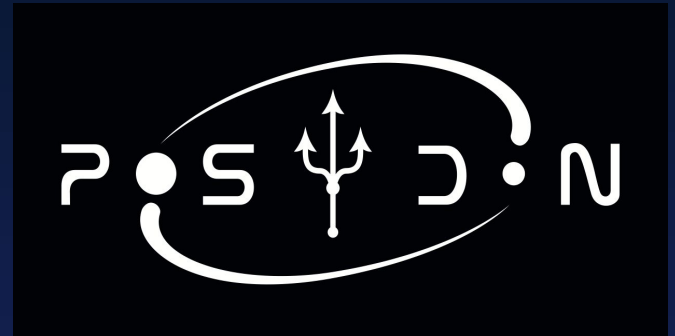
Problem Statement

Astrophysicists studying binary stars use a program called POSYDON to simulate binary star interactions. POSYDON generates a large amount of data (terabytes), which is extremely challenging to search. Our team is developing a database solution to enable the efficient searching and querying of this simulation data for research purposes.

Users - Astrophysicists

- Studying POSYDON simulation data to research binary star system evolutions
- Familiar with the purpose of the POSYDON project
- Unfamiliar with database querying

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Users - Educators

- Not an expert in binary star simulation data
- Goal to create an engaging and interactive learning environment
- Improve student understanding of complex concepts
- Overwhelmed with administrative tasks and lesson plans

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Users - Students

- Undergrad/grad student
- Studying binary star data for school
- Busy with classes and other responsibilities
- Not an expert in Binary Star data

User Needs

- Premade SQL queries
- Ability to convert natural language into a query
- Ability to construct custom queries by selecting parameters from a list
- Ability to save previous queries to a collection
- User-friendly interface
- Customizable data views
- Advanced querying capabilities

Conclusions

- POSYDON is a project that collects data of binary star evolution through various simulations
  - Has collected tens of terabytes of data
  - Needs a tool to collect this data
- Our project aims to design a tool for managing this data in a database
- Will feature user interface to support queries from users familiar and unfamiliar with SQL syntax
- Needs to support astrophysicists, educators, and students