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Computation in the Physical Science

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**PROJECT SEARCH FOR SPACE TREASURE**

10 MINUTE PLAN

INTRODUCTION

The purpose of this project is to create a code that can analyze any microwave amplification by stimulated emission of radiation (MASER) data and return coordinates in the sky for where the MASER is located. This work can be divided into two major sections. The first part is to take the raw data collected and confirm a detection was made. The second part is to take that detection data and to use it to establish the celestial location of the MASER. Both python and astronomical image processing system (AIPS) coding helped to achieve these outcomes.

When the data is received it must be processed and written into tables for analysis (write about data processing). From the processed large data set the first step is to confirm a detection was made. A MASER detection is defined by a sudden large increase in the amplification (which is…) data. Phase diagrams are used to visualize this increased amplification, which appears as a spike when amplification is plotted against the channel. This spike is arguable a more obvious way of identifying there was detection rather than reading through the data, which is why these diagrams are included in this project. Additionally, these diagrams include a second frame witch plots the corresponding phases through out the observing period. Knowing the phase the detection was made in is the real key to establishing the coordinates. Since the data comes in chunks of 30minute observation periods the phases of each of the detections must be deciphered from the large data set into a smaller set of just detection data. The purpose of collecting multiple phase data for each detection is to be able to compare them from each period helping to confirm a more accurate phase of the detection. Think of the phase data as circles of a Venn- diagram, overlapping more and more circles creates distinct point where they all meet, which in this case would be the precise phase the MASER was detected in. Statistical analysis was also used for reassurance of these phase comparisons. (explain stats).

Finally once a detection is confirmed in a phase, steps towards establishing a set of coordinates for the MASER can start. (Physics steps…).

METHOD

The script begins with creating an imports library containing all necessary coding aides. Data is then imported using the open command and a loop to print it line by line. Next another loop is run to resample the data, separating out only the observation amplitudes and phases for each 30minute period. Together this resampled data composes a data table that is used to create each periods phase diagram. This portion of the code first creates a single diagram made by matplotlib’s subplot function so that the phase data and amplitude data are plotted one on top of the other, sharing the same x-axis, the channel count. The lower amplitude plot is a continuous line plot in blue while the upper phase section is a scatter plot with green x points. This plot method is then repeated for each 30minute period by referencing all the resampled data and setting subplots = true. The phase points corresponding to the amplitude spike are also pulled from the resampled data using a function called def detection\_phases. This function uses an if statement to loop through the resampled amplitude data, separating the amplitude greater than (\_), indicating a detection. The loop returns the phase point, which corresponded to the greater amplitudes. Additionally, a second loop is coded in the function allowing only the desired detection points to be printed. Another data table is then created with the first row identifying each 30minute observation period and the columns being the detection phases found in the previous step. A regular expression captured only the time record portion of the headings from the large data set to be column separators at the top of the table. To create the columns data from the detection\_phases function was called and separated out by comas inside double squared brackets [[\_]]. (add stats and physics part/include completed flow chart)

KEY VARIABLES AND FUNCTIONS

pd = pandas library

plt = matplotlib.pyplot library (for plotting)

re = re library (for regular expressions)

readings= large processed data set

re\_ampl = amplitude data separated by 30minute observation periods

re\_phase = phase data separated by 30mintue observation periods

resampled = resampled data set of re\_ampl and re\_phase

subplot 1 = plot of phase vs. channel (top of phase diagram)

subplot 2 = plot of amplitude vs. channel (bottom of phase diagram)

def detection\_phases = function for finding phase pts for greater amplitudes