

Rapid proton capture process in type I X-ray bursts generated in LMXBs with the effects of nuclear masses

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Abstract

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Preface

Jyväskylä January 1, 2020

Olli Opiskelija

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1 Introduction

2 Theoretical background

2.1 Low Mass X-ray Binaries

2.1.1 Nuclear reaction network

2.1.2 Rapid Proton Capture Process

Hot CNO cycle. Hydrogen burning overcoming the Coulomb barrier via pp-chains.
Temperatures for HCNO $T = 0.1 - 0.4$ GK

2.1.3 Total Reaction Rate

Total reaction rate:

$$\begin{aligned}
 N_A \langle \sigma v \rangle_{total} = & \sum_i N_A \langle \sigma v \rangle_{narrow\ resonances}^i \\
 & + \sum_k N_A \langle \sigma v \rangle_{broad\ resonances}^k \\
 & + N_A \langle \sigma v \rangle_{non\ resonant} \\
 & + N_A \langle \sigma v \rangle_{continuum}
 \end{aligned} \tag{1}$$

2.1.4 Light Emission Curves

2.2 TALYS

2.2.1 Hauser-Feshbach statistical model

2.2.2 Parameters

2.3 Winnet

3 Methods and materials

3.1 Nuclear masses measured at IGISOL

3.2 Usage of TALYS

3.3 Usage of Winnet

3.4 Simulation of Light Curves

4 Results

4.1 Simulated Light Curves

5 Conclusions

A First appendix

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B Second appendix

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