

# ASTR 531 - Stellar Interiors and Evolution

Exam 2

TOM WAGG

May 17, 2022

## Getting a white dwarf to chill out

Prof. Eyemund Returns

*Dearest Grad Student,*

*I have good news and bad news. The bad news is that it seems that our venture into the diamond creation business has gone slightly awry. The other faculty became suspicious after they noticed I was using that goblet of diamonds as a paperweight and after some lengthy arguments I have been legally forbidden from ever using white dwarfs for diamond production! The good news? Well they didn't say anything about neutron stars...*

*Now the problem of course is that we've invested quite a lot of ~~your PhD funding~~ money into finding that sample of white dwarfs. But I realised we don't need to find a neutron star, we just need to make a neutron star!!*

*So I've done some experiments with adding mass to existing white dwarfs, but for some reason none of them reach the Chandrasekhar limit before exploding dramatically. I'm not entirely sure why this happens but it seems to be temperature dependent, therefore I've acquired a Cooling Ray to stop the photosphere from getting too hot! It can cool at any rate we want, but it costs more to do so. So my question for you is **What's the lowest rate we could cool the outer layers of a white dwarf whilst it accretes material and still create a neutron star?***

*Yours sincerely,  
Prof. D. Eyemund*

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### ***Part a - What's with those explosions?***

*Explain what is physically occurring at the surface of the white dwarf to cause explosions as the temperature increases during accretion*

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### ***Part b - How quickly do we need to cool it?***

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