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Models of X-ray Bursts

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Type I X-ray bursts are thermonuclear explosions that occur on the surfaces of neutron stars that accrete matter from their binary companions. Since their discovery over 30 years ago, observers have detected thousands of X-ray bursts, while theorists have developed X-ray burst models with ever-increasing complexity and sophistication. While there is now some accord between theory and observations, a few severe discrepancies remain. Chief among them is the range of accretion rates within which thermonuclear burning triggers X-ray bursts. In this talk, I will review our current understanding of the physics of the thermal instability that triggers X-ray bursts, with an emphasis on the pertinent nuclear reactions. In particular, I will discuss the roles that both the hot CNO cycles and their breakout reactions ^{15}O(α,γ)^{19}Ne and ^{18}Ne(α,p)^{21}Na play in the stability of thermonuclear burning and the rising phase of X-ray bursts.