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Solar Flares: Explosive Plasma Physics!

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Solar flares are among the most powerful explosions in the solar system. They cause strong variations in the EUV and X-ray output of the Sun, and in the radiative forcing of Earth's upper atmosphere. Their rate of occurrence follows the ˜11 year solar activity cycle and they take place in active regions; the locations of strong magnetic fields in the Sun's atmosphere that are anchored in sunspots. The temperatures reached by flaring plasma exceed tens of millions of degrees Kelvin, perhaps even one hundred million degrees in the most energetic events. We are fortunate to live in an age during which we have access to an array of powerful observing instruments that have allowed us to begin unravelling the properties of solar flares, but there remains much to learn about their underlying physics and, in particular, the mechanism which drives them. During this plenary I will present some of what we have discovered about flares from an observational perspective and then I will describe the challenges associated with modeling these extreme events. The challenges are severe, but they must be overcome because modeling provides a crucial tool for guiding interpretations of the observational data. Finally, I will show some of my research group's most recent progress and findings.