Chromospheric solar flares

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Abstract

Solar flares are sudden and short-lived flashes of radiation in the solar atmosphere. The total energy released in the form of flare radiation can be up to 10^{32} erg; this is provided by reconfiguration of stressed coronal magnetic field to a lower energy state. Solar flares are often closely associated with coronal mass ejections (CMEs), and the most intense radiation – which occurs in the opticaland UV parts of the spectrum. Solar flares were first observed in the optical range in 1859 by Carrington as rapid brightenings in photospheric white light. In early 20th century flares were assumed to be entirely chromospheric, based solely on the energetics implied by the enormous optical brightenings. However, further development of the UV and X-ray observing techniques revealed that the flares involve mainly coronal magnetic structures, where the energy is released in the reconnection process and transferred to the lower, chromospheric parts of solar atmosphere. Therefore, the solar chromosphere – the narrow, complex interface between the photosphere and corona – remains of primary interest during flares. The majority of the flare's radiative output originates here, making it the main source of flare diagnostic information. Using chromospheric radiation we can deduce flare heating and ionization, and subsequent cooling and de-excitation of different layers of the atmosphere as well as flows, non-thermal velocities, and the character of the non-thermal particle distributions. During my talk I will present the main characteristics and physical properties of solar flaring chromospheres. Their new observations and the results of theoretical modelling will be also discussed.