The June 2008 flare of Markarian 421 from optical to TeV energies

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We present optical, X-ray, high energy ($\lessapprox 30$ GeV) and very high energy ($\gtrapprox 100$ GeV; VHE) observations of the high-frequency peaked blazar Mrk 421 taken between 2008 May 24 and June 23. A high energy γ-ray signal was detected by AGILE with \sqrt{TS}=4.5 on June 9--15, with $F(E>100 \mathrm{MeV})= 42^{+14}_{-12}\times 10^{-8}$ photons cm^{-2} s^{-1}. This flaring state is brighter than the average flux observed by EGRET by a factor of $\sim$3, but still consistent with the highest EGRET flux. In hard X-rays (20-60 keV) SuperAGILE resolved a 5-day flare (June 9-15) peaking at $\sim$ 55 mCrab. SuperAGILE, RXTE/ASM and Swift/BAT data show a correlated flaring structure between soft and hard X-rays. Hints of the same flaring behavior are also detected in the simultaneous optical data provided by the GASP-WEBT. A Swift/XRT observation near the flaring maximum revealed the highest 2-10 keV flux ever observed from this source, of 2.6 $\times 10^{-9}$ erg cm^{-2} s^{-1} (i.e. > 100 mCrab). A peak synchrotron energy of $\sim$3 keV was derived, higher than typical values of $\sim$0.5-1 keV. VHE observations with MAGIC and VERITAS on June 6-8 show the flux peaking in a bright state, well correlated with the X-rays. This extraordinary set of simultaneous data, covering a twelve-decade spectral range, allowed for a deep analysis of the spectral energy distribution as well as of correlated light curves. The γ-ray flare can be interpreted within the framework of the synchrotron self-Compton model in terms of a rapid acceleration of leptons in the jet.