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We conducted an observational campaign towards one of the most massive and luminous colliding wind binaries in the Galaxy, HD 93129A, close to its periastron passage in 2018. During this time the source was predicted to be in its maximum of high-energy emission. We present the results from our observations with the X-ray satellites *Chandra* and *NuSTAR* and the γ-ray satellite *AGILE*. High-energy emission coincident with HD 93129A was detected in the X-ray band up to ~18 keV, whereas in the γ-ray band only upper limits were obtained. We interpret the derived fluxes using a non-thermal radiative model for the wind-collision region. We estimate the fraction of the wind kinetic power that is converted into relativistic electron acceleration and the magnetic field in the wind-collision region. We conclude that multiwavelength, dedicated observing campaigns during carefully selected epochs are a powerful tool for characterizing the relativistic particle content and magnetic field intensity in colliding wind binaries.