

Coronagraph Experiments with Dynamic Range Absorption by Pre-optics

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A novel method to absorb a part of the required dynamic range is developed. It works as pre-optics in front of any coronagraph. It consists of an unbalanced nulling interferometer and an adaptive optics with two deformable mirrors. It reduces the speckle level from $1E-8$ caused by a $\lambda/1000$ wavefront to $1E-10$ by $\lambda/10000$ and the central star intensity by $1/100$. Because the quantity of wavefront errors at the AO and the coronagraph is converted by a reduction factor of the unbalanced nulling interferometer, the required wavefront error level of $\lambda/10000$ can be achieved by $\lambda/1000$ optics with the reduction factor of 10. A downstream coronagraph is required to achieve the rest of the dynamic range of $1E-8$ which can be achieved by $\lambda/1000$ level optics. A common-path AIC is a candidate of the downstream coronagraph which consists of a 3D Sagnac nulling interferometer using achromatic geometric phase shift by mirror reflections.