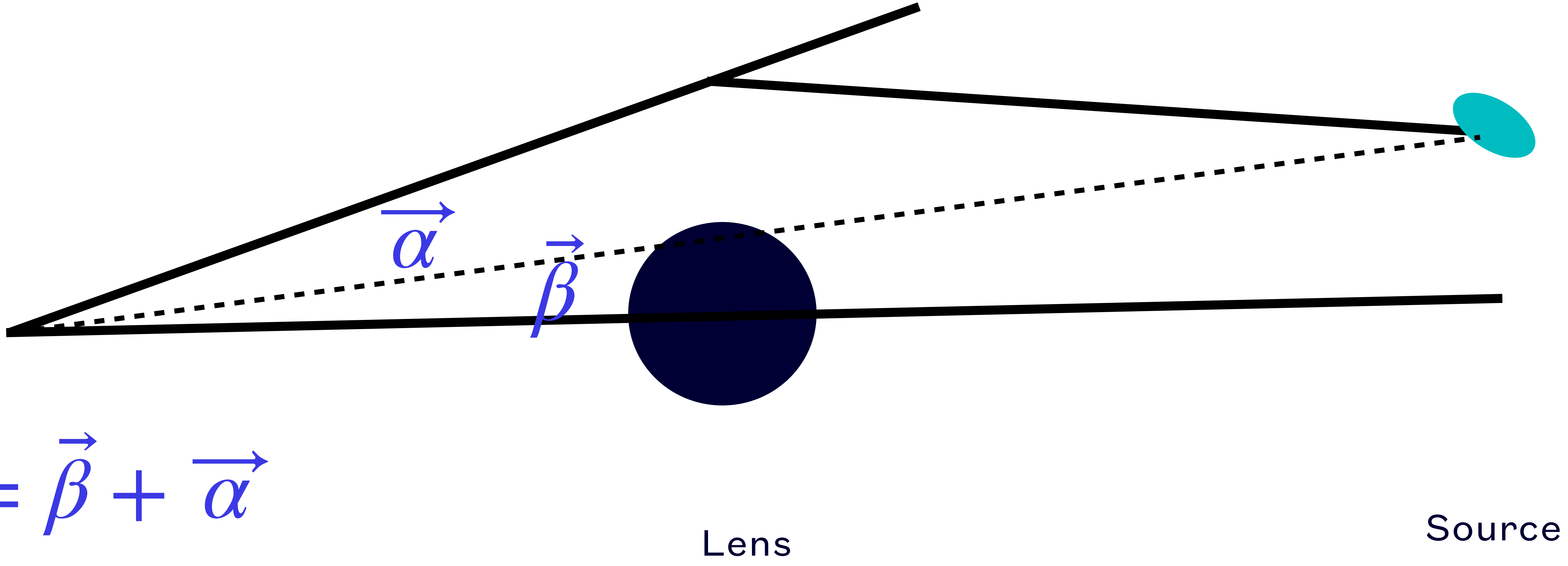
Scalars, Vectors and Spin-2 fields



$$\vec{\theta} = \vec{\beta} + \overrightarrow{\alpha}$$

θ is the observed angle, β is the unlensed position, α is the deflection angle

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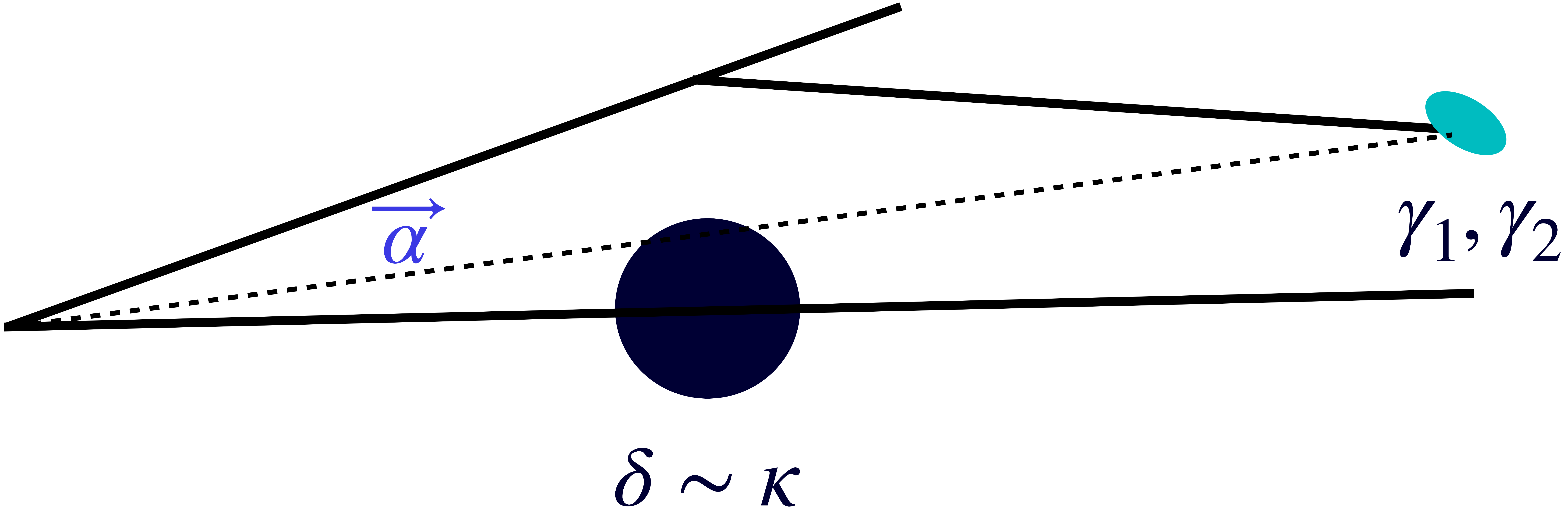

$\delta, \gamma_1, \gamma_2$ are all directly observable quantities, α is not (except statistically CMB lensing + magnification)

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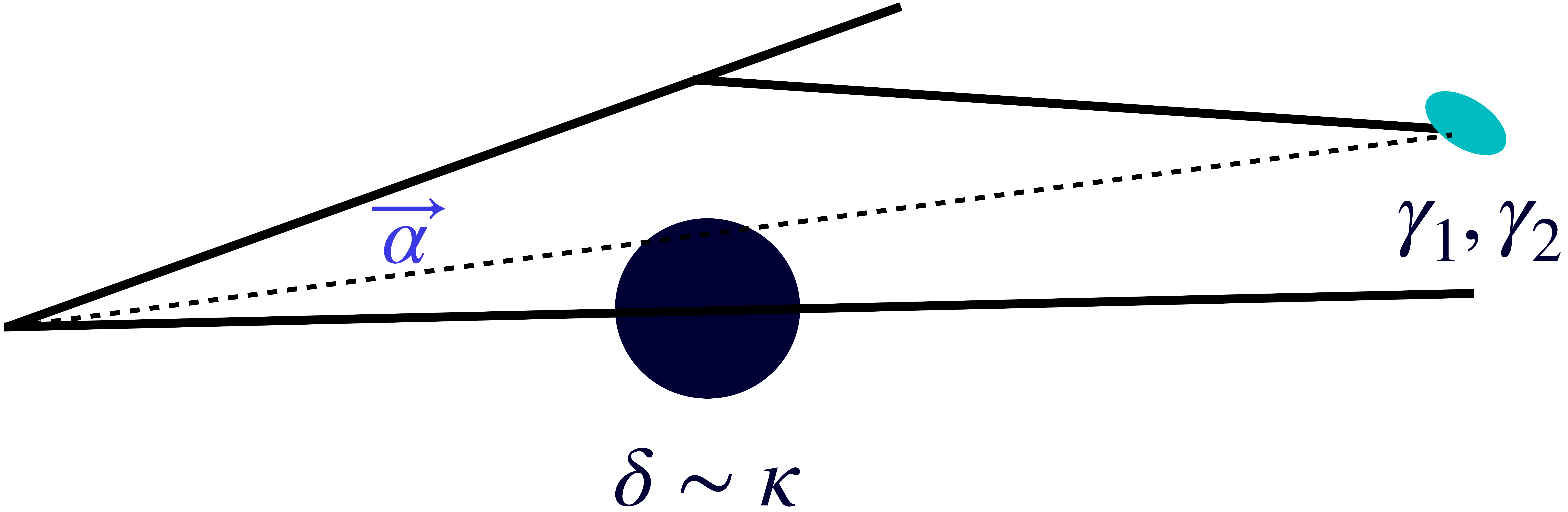

However $\frac{d\delta}{dt} \neq 0$, therefore $\frac{d\alpha}{dt} \neq 0$

Scalars, Vectors and Spin-2 fields

With some physics we can write down 3-fields with respect to the gravitational potential (easiest in harmonic space)

- Scalar: $\delta(\overrightarrow{\ell}) = A\ell^2\Phi(\overrightarrow{\ell})$
- Vector: $\dot{\overrightarrow{\alpha}}(\overrightarrow{\ell}) = B\ell e^{i\phi_\ell}\Phi(\overrightarrow{\ell})$
- Spin-2: $\boldsymbol{\gamma} = C\ell^2 e^{2i\phi_\ell}\Phi(\overrightarrow{\ell})$

where $\phi_\ell = \tan^{-1}\left(\dfrac{\ell_2}{\ell_1}\right)$

Power-spectra for these fields

- Scalar: $C^{\delta\delta}(\ell) = A^2\ell^4 P_\Phi(\ell)$
- Vector: $C^{\dot{\alpha}\dot{\alpha}}(\ell) = B^2\ell^2 P_\Phi(\ell)$
- Spin-2: $C^{\gamma\gamma}(\ell) = C^2\ell^4 P_\Phi(\ell)$

Power-spectra for these fields

- Scalar: $C^{\delta\delta}(\ell) = A^2\ell^4 P_\Phi(\ell)$
- Vector: $C^{\dot\alpha\dot\alpha}(\ell) = B^2\ell^2 P_\Phi(\ell)$
- Spin-2: $C^{\gamma\gamma}(\ell) = C^2\ell^4 P_\Phi(\ell)$

- Scalar: $C_\ell^{\delta\dot\alpha} = AB\ell^3 P_\Phi(\ell)$
- Vector: $C_\ell^{\delta\gamma} = AC\ell^4 P_\Phi(\ell)$
- Spin-2: $C_\ell^{\dot\alpha\gamma} = BC\ell^3 P_\Phi(\ell)$