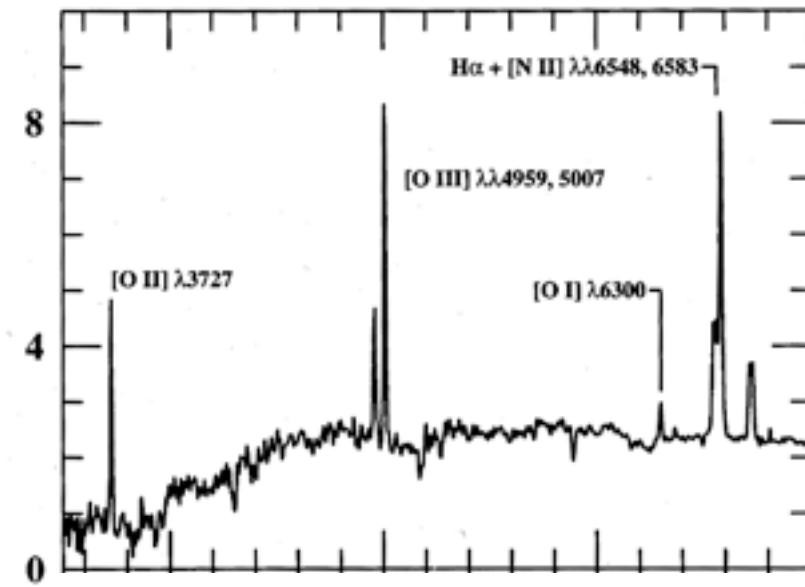
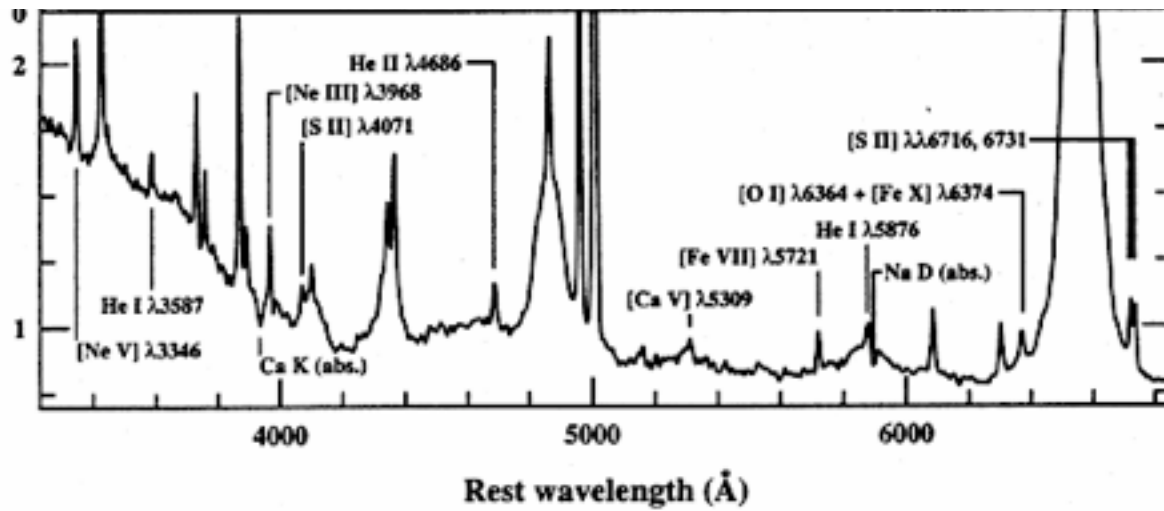


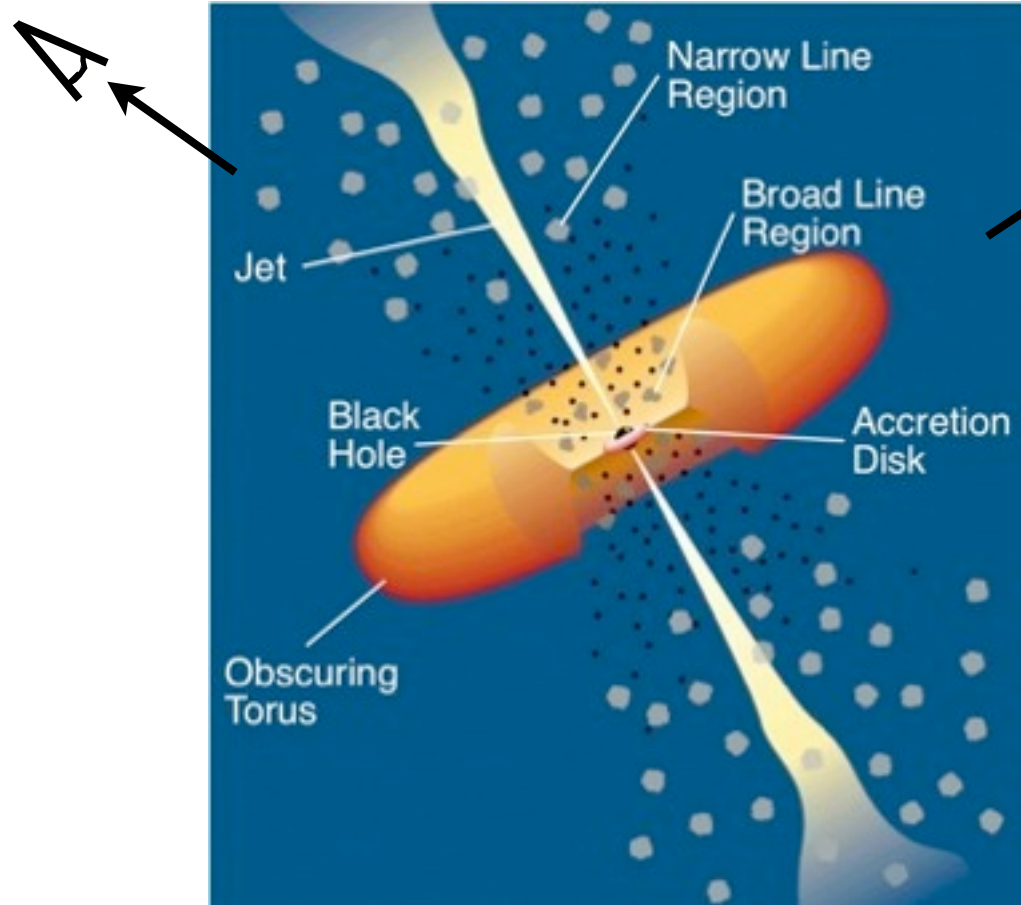
“Feedback in Luminous Obscured Quasars”

Jenny Greene,
Nadia Zakamska, Luis Ho, & Aaron Barth

arXiv:1102.2913

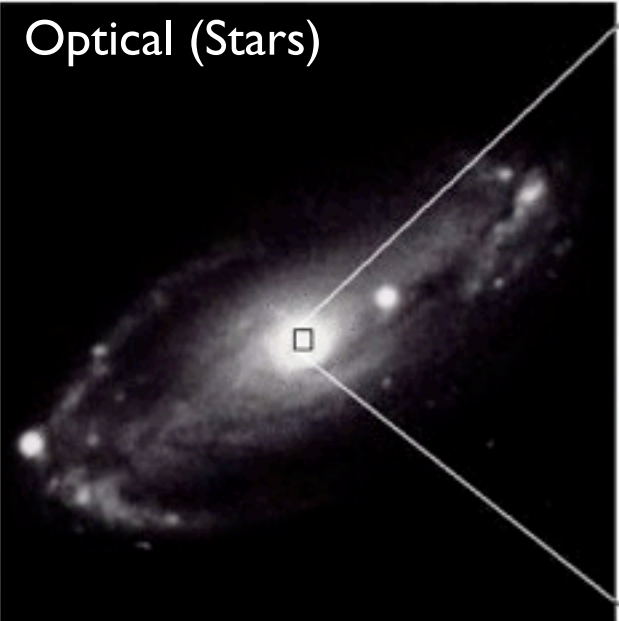


Broad-Line
AGN



Narrow-Line
AGN

Optical (Stars)

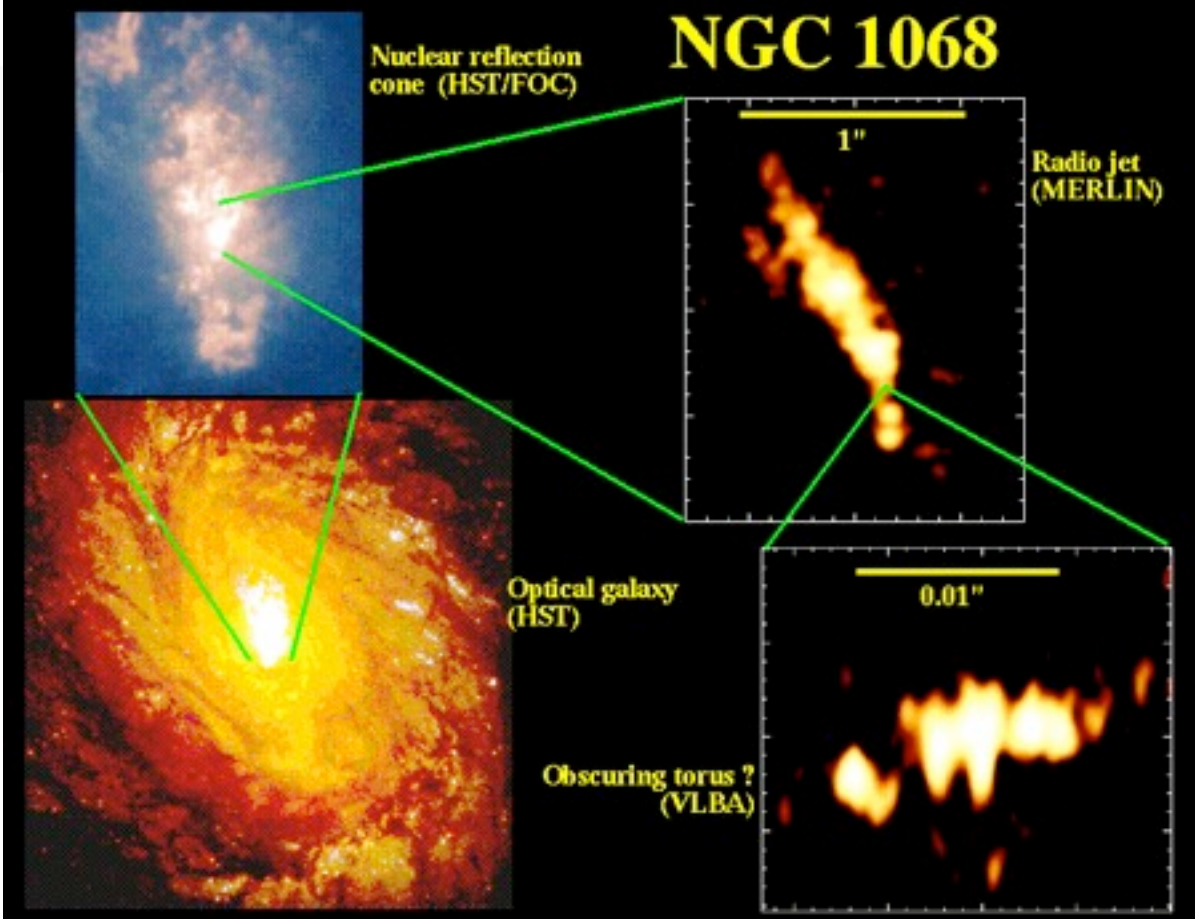


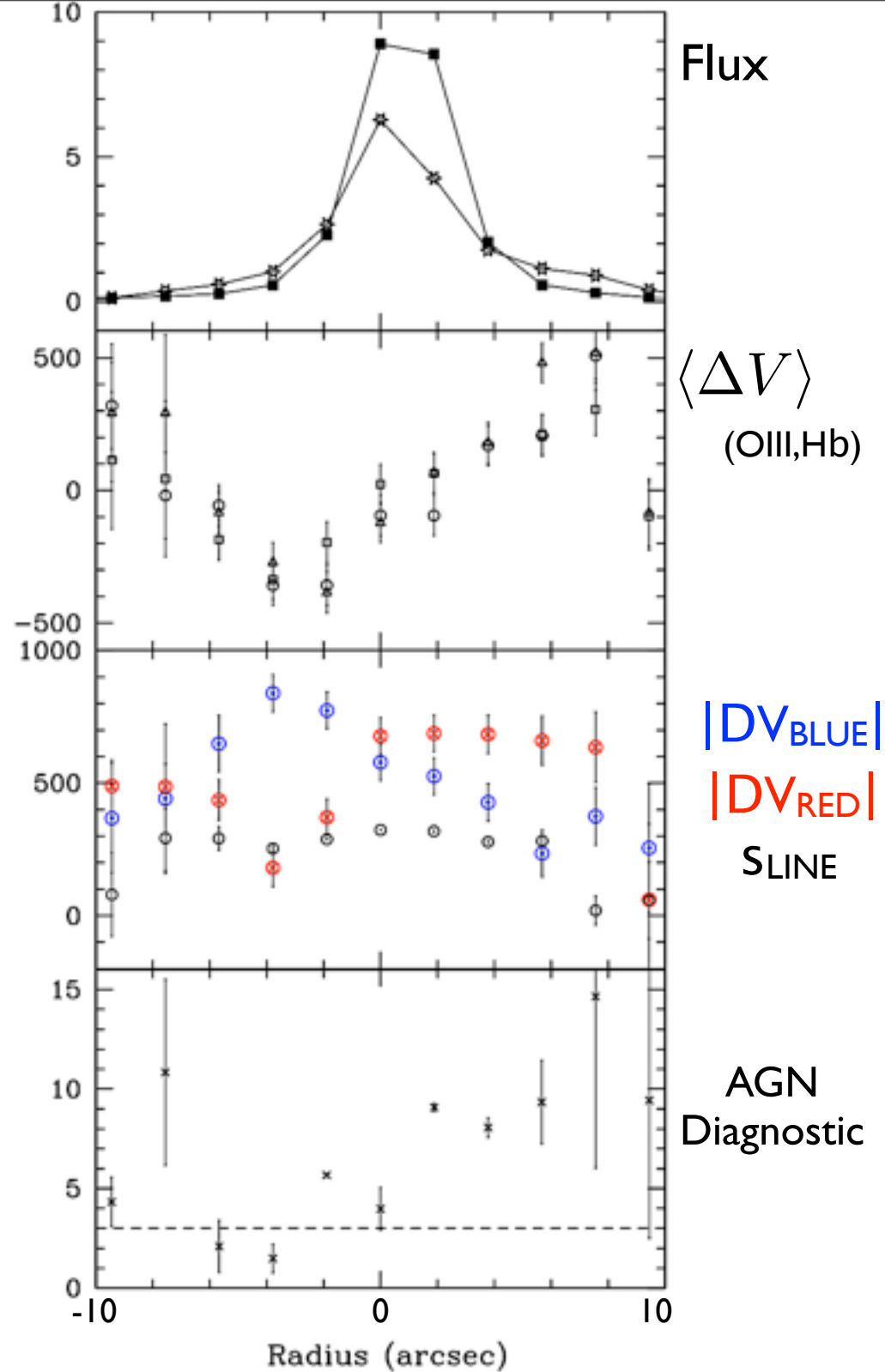
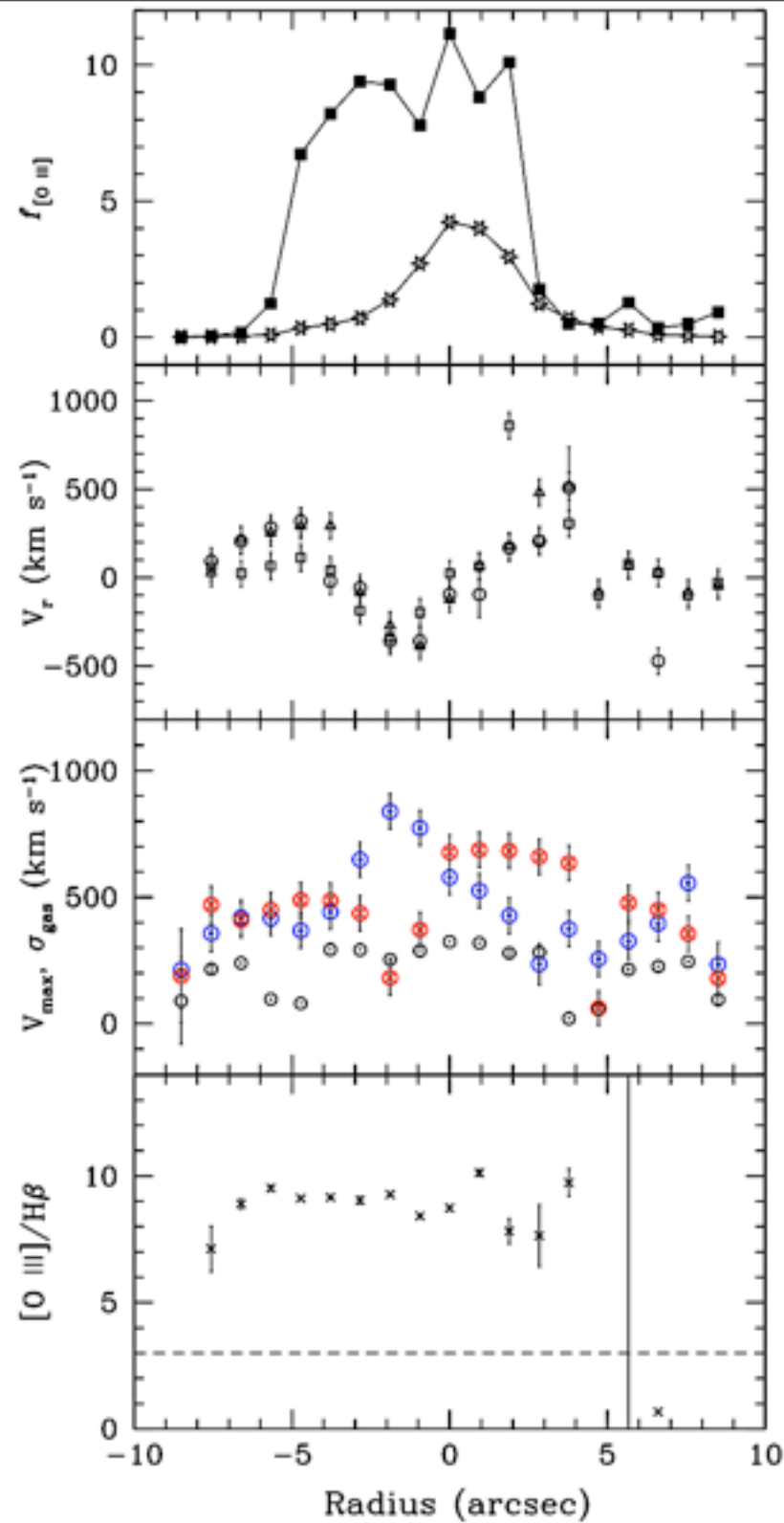
OIII Ionization Cone

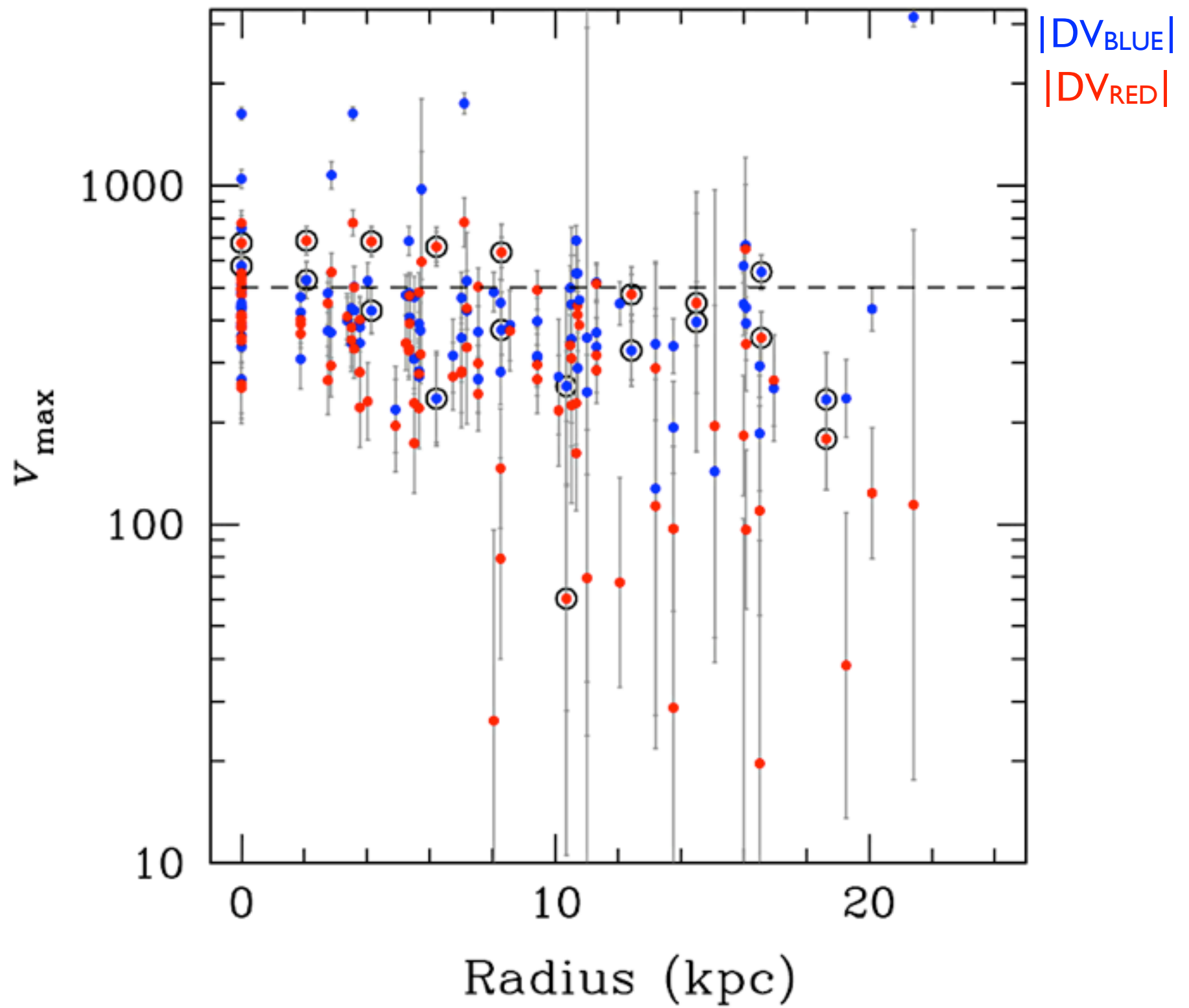


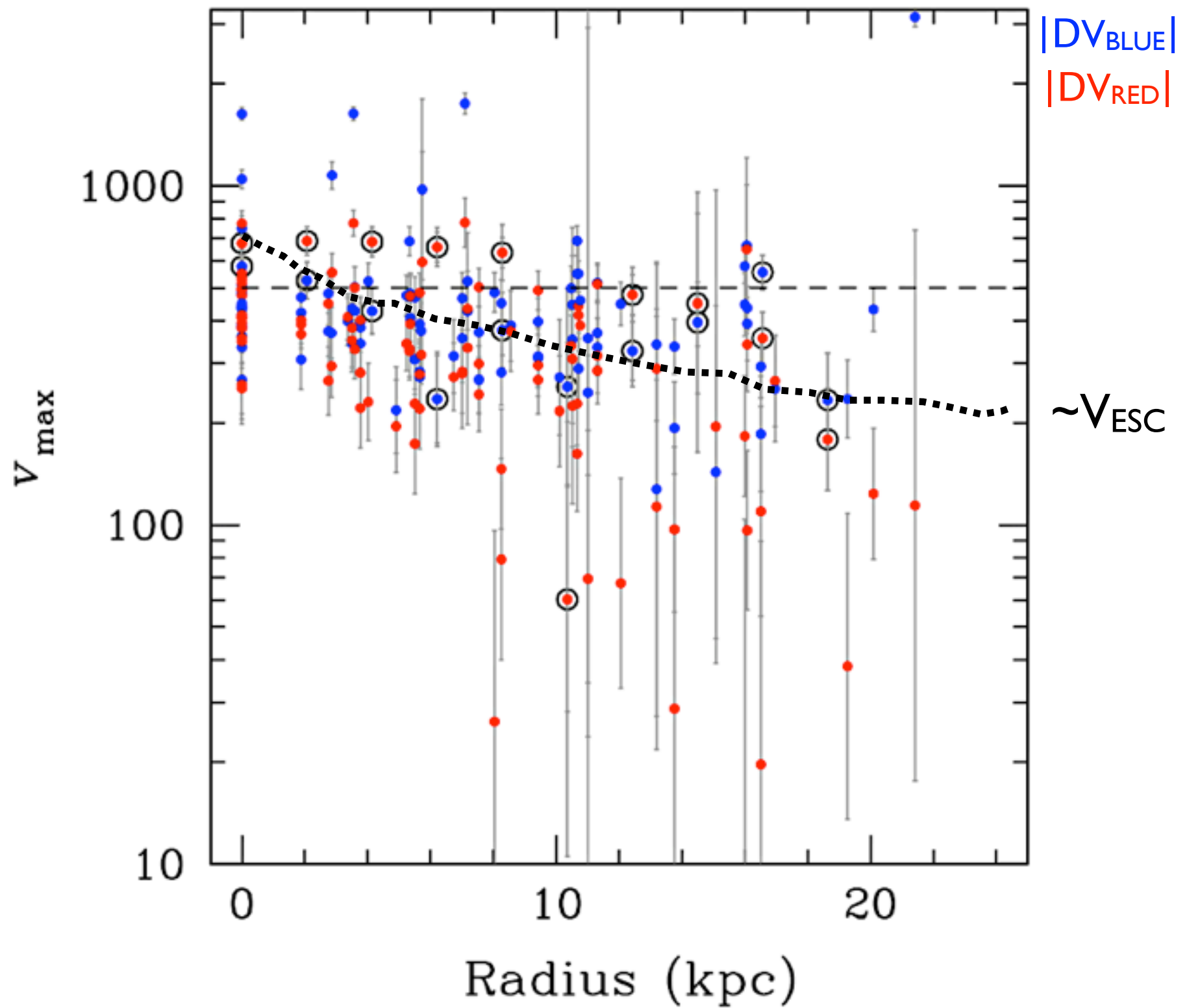
NGC 5728

NGC 1068

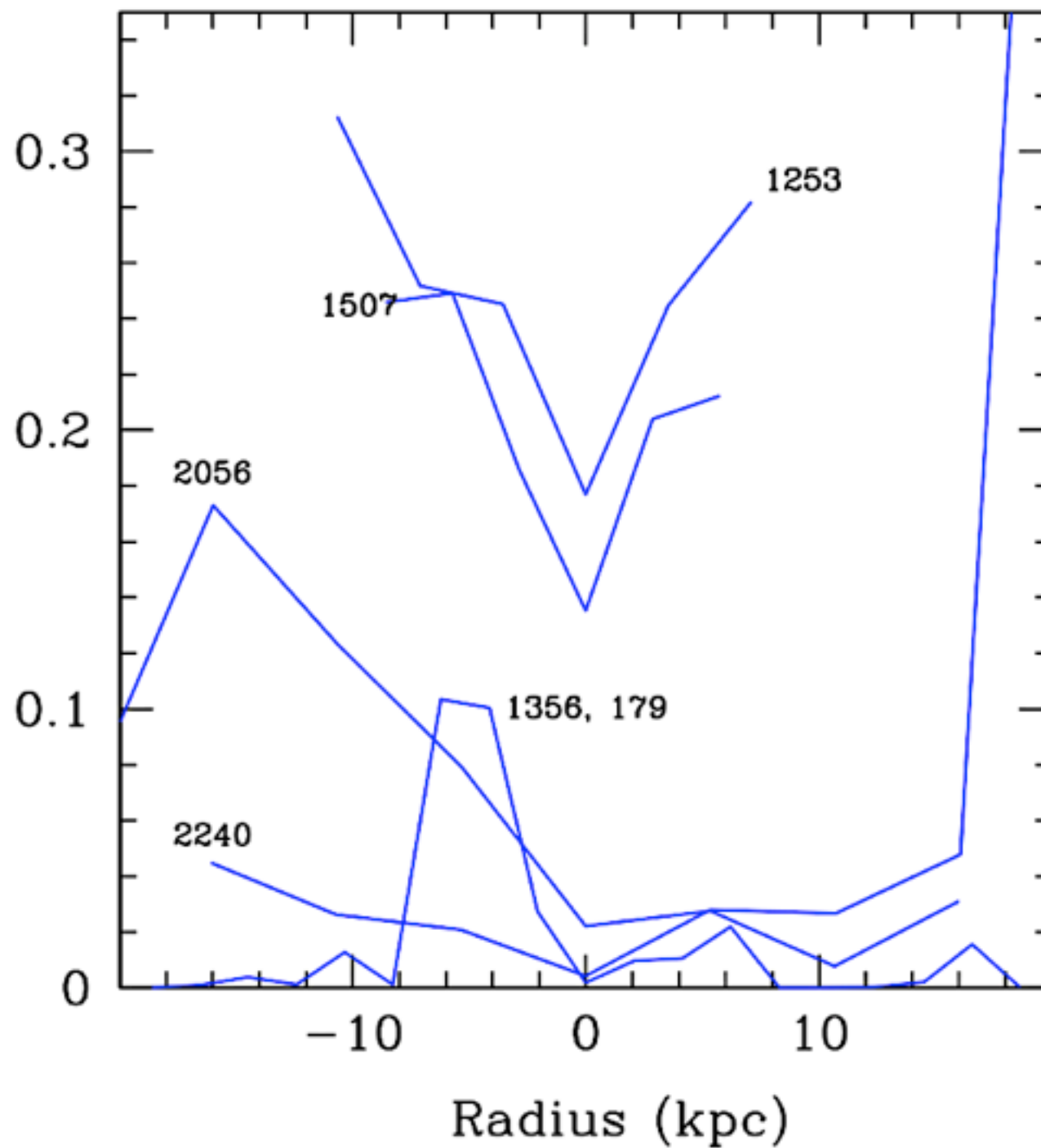








Fraction
with
projected
 $V > V_{\text{ESC}}$



$$\dot{M}_{\text{outflow}} \sim \rho_{\text{gas}} R^2 V$$

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From ionization
states of gas
(cross-checked
with scattering):
 $\sim 0.1\text{-}1 \text{ cm}^{-3}$

$\sim 5\text{-}10 \text{ kpc}$

$\sim 200\text{-}700 \text{ km/s}$

$$\dot{M}_{\text{outflow}} \sim \rho_{\text{gas}} R^2 V$$

From ionization
states of gas
(cross-checked
with scattering):
 $\sim 0.1 - 1 \text{ cm}^{-3}$

$\sim 5 - 10 \text{ kpc}$

$\sim 200 - 700 \text{ km/s}$

$$\sim 50 - 1000 M_{\text{sun}}/\text{yr}$$

$$\dot{M}_{\text{outflow}} \sim \rho_{\text{gas}} R^2 V$$

From ionization
states of gas
(cross-checked
with scattering):
 $\sim 0.1 - 1 \text{ cm}^{-3}$

$\sim 5 - 10 \text{ kpc}$

$\sim 200 - 700 \text{ km/s}$

$$\sim 50 - 1000 M_{\text{sun}}/\text{yr}$$

$$\dot{E}_{\text{outflow}} \sim \frac{1}{2} \dot{M}_{\text{outflow}} v^2$$

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$\sim 5 - 10 \text{ kpc}$

$\sim 200 - 700 \text{ km/s}$

$$\sim 50 - 1000 M_{\text{sun}}/\text{yr}$$

$$\dot{E}_{\text{outflow}} \sim \frac{1}{2} \dot{M}_{\text{outflow}} v^2$$

$$\sim 10^{42} - 10^{44} \text{ erg/s}$$

$$\sim 0.001 - 0.1 L_{\text{QSO}}$$

$$\dot{M}_{\text{outflow}} \sim \rho_{\text{gas}} R^2 V$$

From ionization
 states of gas
 (cross-checked
 with scattering):
 $\sim 0.1 - 1 \text{ cm}^{-3}$

$\sim 5 - 10 \text{ kpc}$

$\sim 200 - 700 \text{ km/s}$

$$\sim 50 - 1000 M_{\text{sun}}/\text{yr}$$

$$\dot{P}_{\text{outflow}} \sim \dot{M}_{\text{outflow}} v$$

$$\dot{M}_{\text{outflow}} \sim \rho_{\text{gas}} R^2 V$$

From ionization
states of gas
(cross-checked
with scattering):
 $\sim 0.1 - 1 \text{ cm}^{-3}$

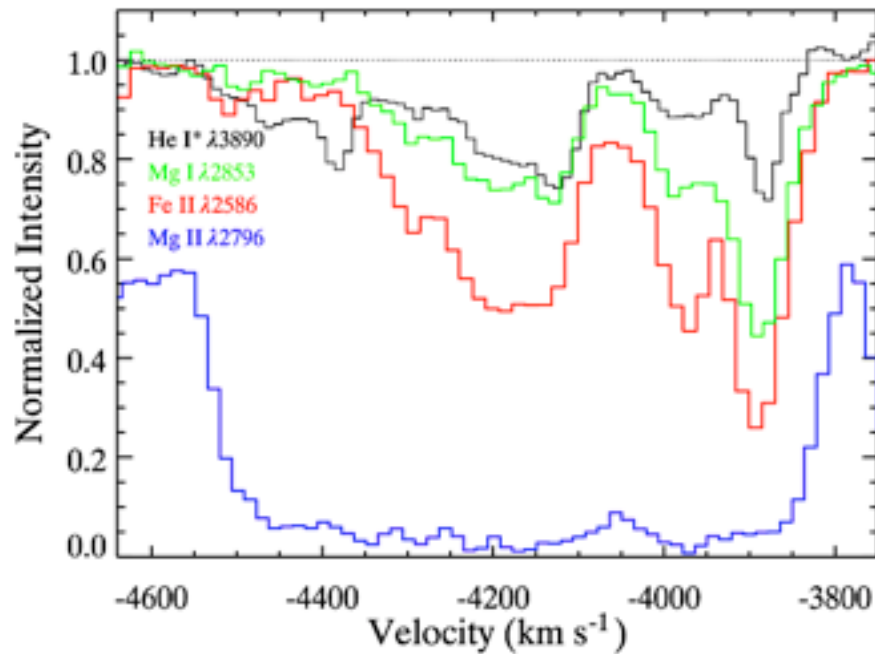
$\sim 5 - 10 \text{ kpc}$

$\sim 200 - 700 \text{ km/s}$

$$\sim 50 - 1000 M_{\text{sun}}/\text{yr}$$

$$\dot{P}_{\text{outflow}} \sim \dot{M}_{\text{outflow}} v$$

$$\sim 1 - 30 \left(\frac{L_{\text{QSO}}}{c} \right)$$

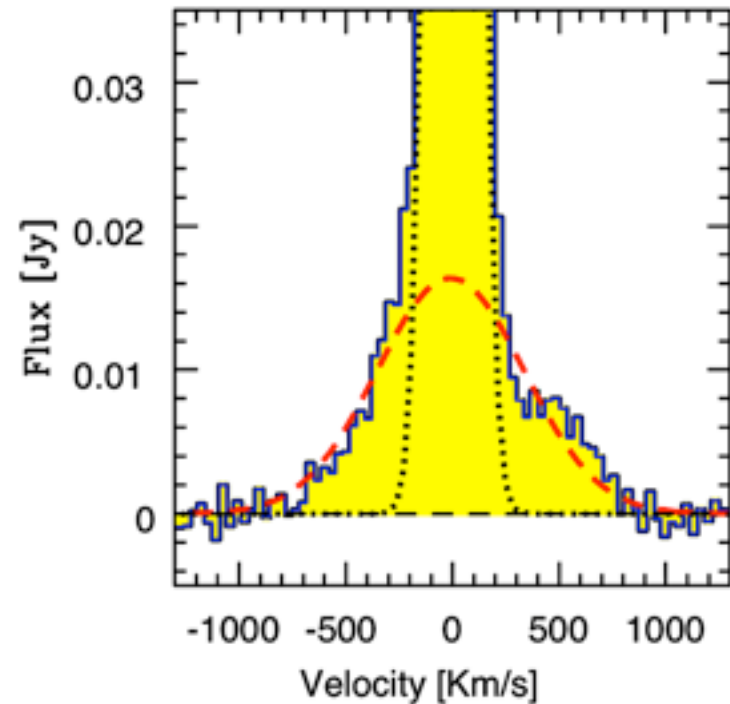


Arav et al.
BAL QSOs:

$$R_{\text{wind}} \sim 1 - 20 \text{ kpc}$$

$$v \gtrsim 1000 \text{ km s}^{-1}$$

$$\dot{M}_{\text{wind}} \sim 100 - 600 M_{\odot} \text{ yr}^{-1}$$



Feruglio et al., Fischer et al.
Mrk 231 Molecular Outflows:

$$R_{\text{wind}} \sim 1 - 4 \text{ kpc}$$

$$v > 500 \text{ km s}^{-1}$$

$$\dot{M}_{\text{wind}} \gtrsim 1000 M_{\odot} \text{ yr}^{-1}$$

(Also Alatalo et al (NGC 1266);
Genzel et al., more objects in prep!)

