X-ray jets from active galactic nuclei

Part A: 1D fluid model of a jet (3.8 points)

A.1 $(0.3\ \mathrm{pt})$

$n'(s) =$

A.2 $(0.2\ \mathrm{pt})$

$F_{\mathrm{p}}(s) =$

A.3 $(0.5\ \mathrm{pt})$

A.4 $(0.6\ \mathrm{pt})$

A.5 $(0.6\ \mathrm{pt})$

$\frac{dP_{\mathrm{j}}}{ds} =$

A.6 $(0.4\ \mathrm{pt})$

Expression for calculating $\dot{M}$:

$\dot{M}_1 =$

$\dot{M}_2 =$

A.7 $(0.5\ \mathrm{pt})$

Expression:

$\Pi =$

Numerical:

$\Pi =$

A.8 (0.5 pt)

$F_{\mathrm{Pr}} =$

A.9 (0.2 pt)
Relationship:

% deviation $=$

Part B: Gas of ultra relativistic electrons (2.2 points)

B.1 (0.2 pt)

B.2 (0.8 pt)

$\frac{\Delta p_z}{\Delta t} =$

B.3 (0.6 pt)

B.4 (0.6 pt)

Part C: Synchrotron emission (1.7 points)

C.1 (0.7 pt)

$\Omega =$

C.2 (0.5 pt)

$\Delta t =$

C.3 (0.3 pt)

ν_{chr} =

C.4 (0.2 pt)

$\tau =$

Part D: Synchrotron emission from an AGN jet (2.3 points)

D.1 (0.4 pt)

$B =$

D.2 (1.0 pt)

$f(\epsilon) =$

D.3 (0.3 pt)

Synchrotron cooling will make the distribution:

☐ shallower, ☐ steeper, ☐ other

D.4 (0.6 pt)

AGN	Knot	Likely cause of cooling	Question parts which support your conclusion
Cen A	AX1C	☐ synchrotron cooling ☐ adiabatic expansion ☐ neither	
Cen A	BX2	☐ synchrotron cooling ☐ adiabatic expansion ☐ neither	
M87	HST-1	☐ synchrotron cooling ☐ adiabatic expansion ☐ neither	
M87	Knot A	☐ synchrotron cooling ☐ adiabatic expansion ☐ neither	