Particle acceleration in supernova remnant expanding inside wind-blown bubble

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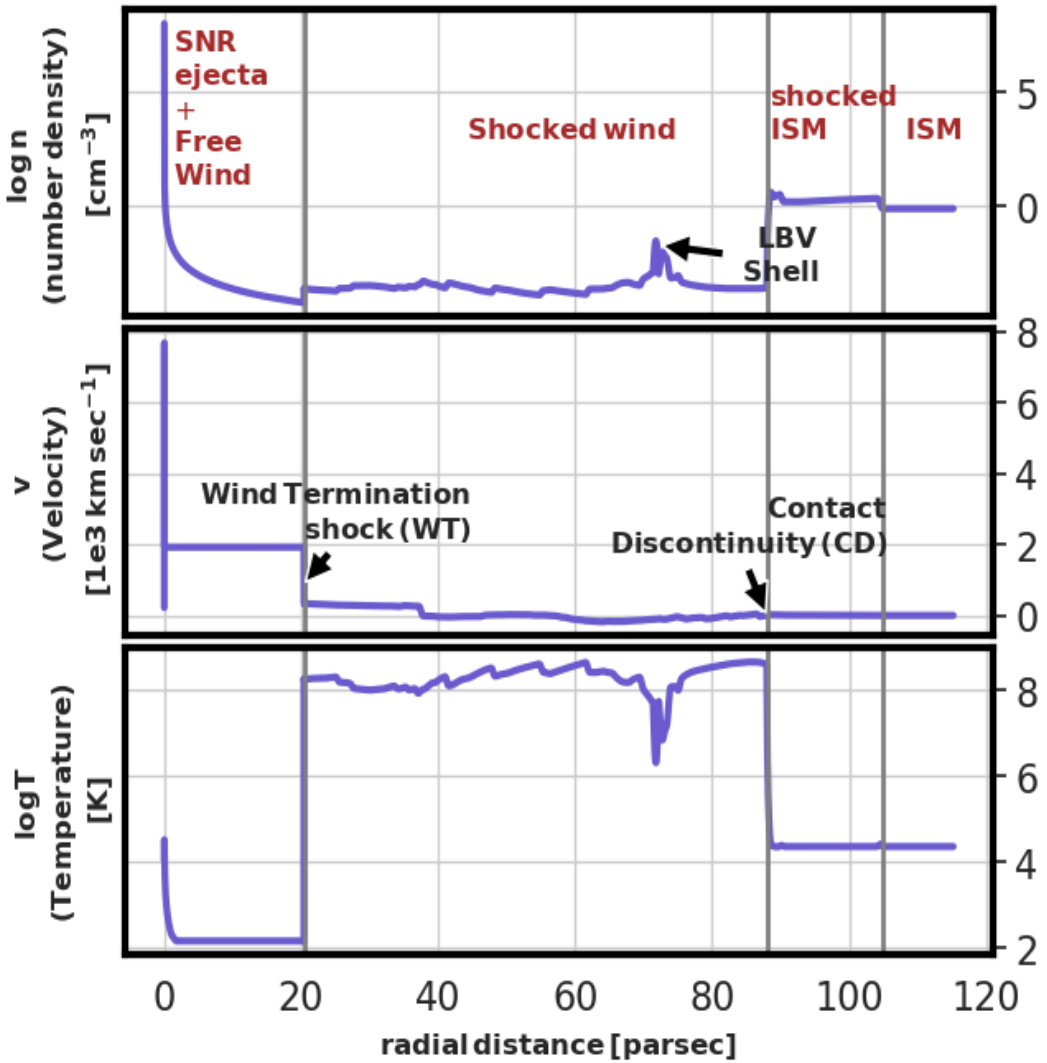
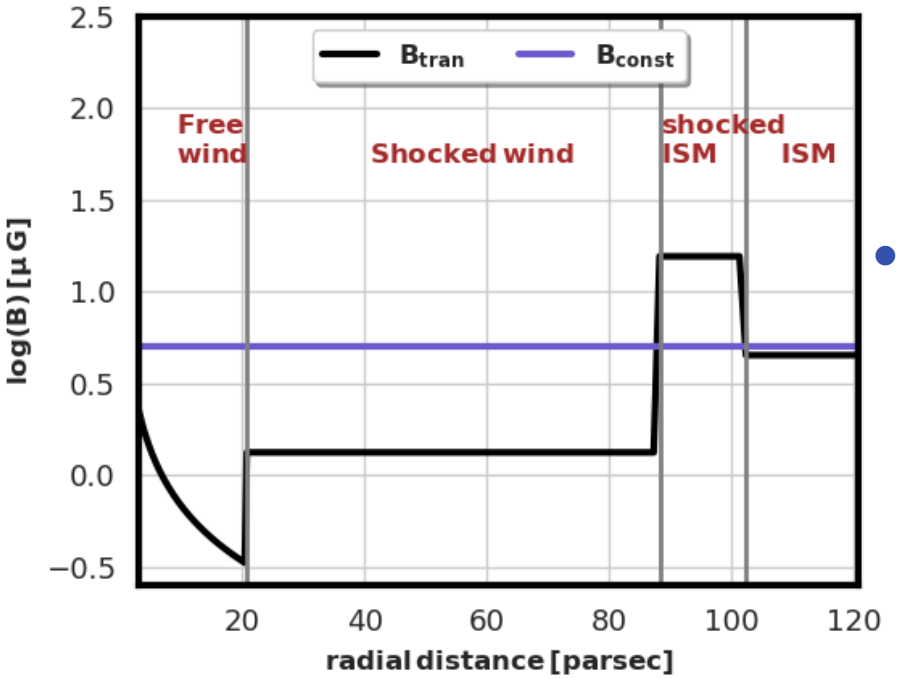
Numerical modelling

Hydrodynamics after supernova explosion



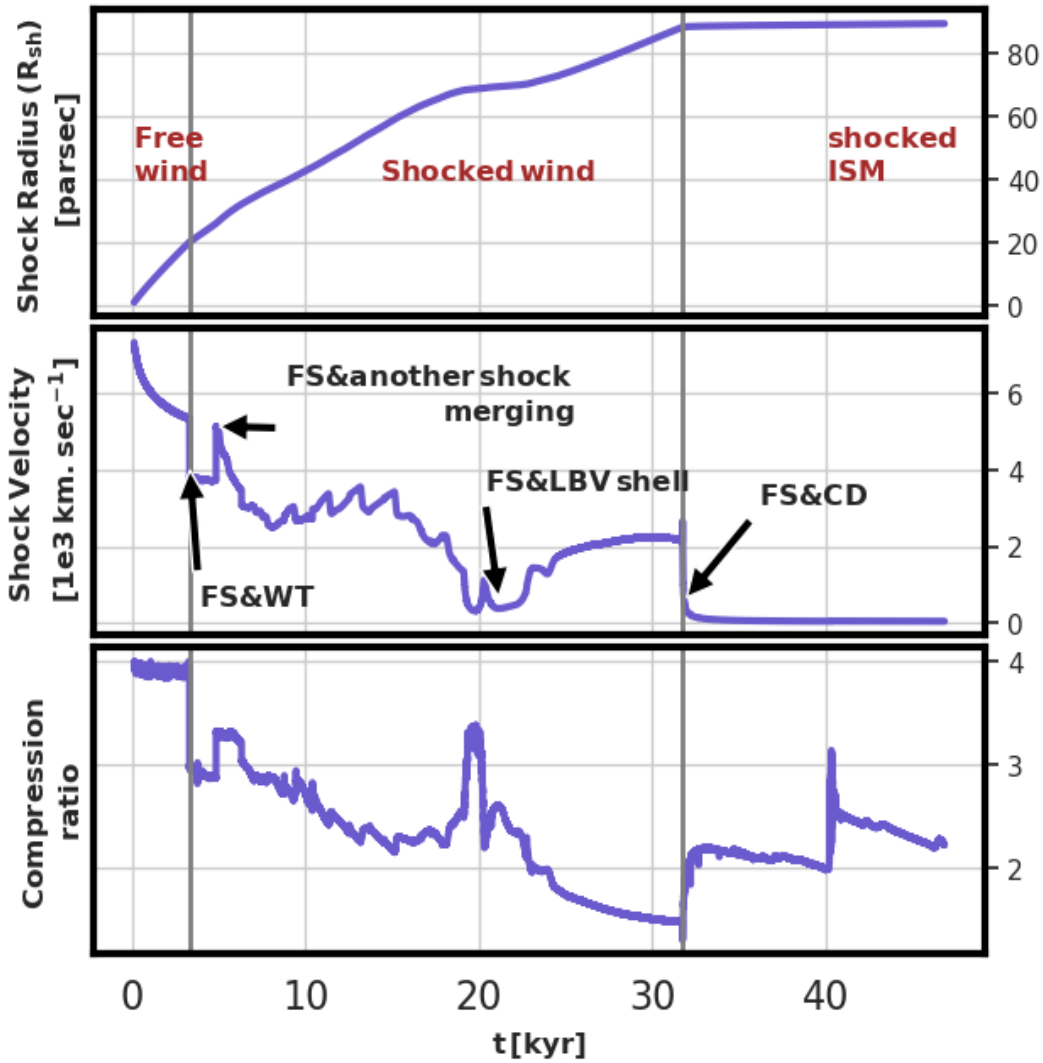
Numerical modelling

CSM magnetic field (B)



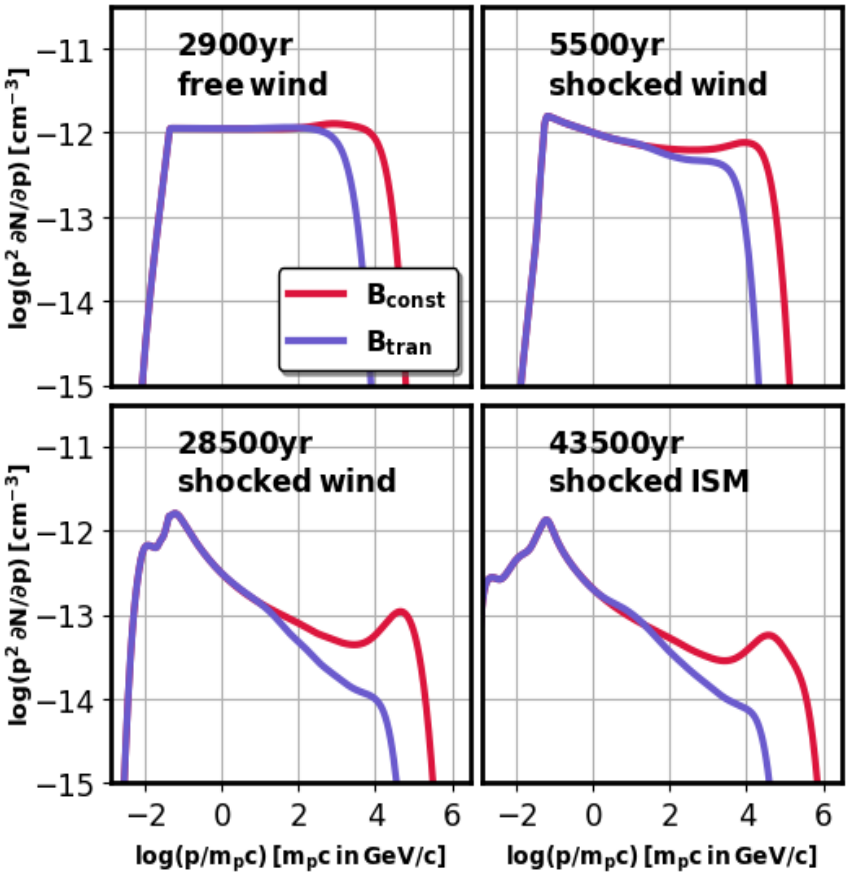
- B_{const} → Simple field configuration
  $B_d = 16.5\mu G$, $B_u = 5\mu G$ and assumed to be constant with time
- B_{tran} →
  1. Realistic configuration with **lower field strength** except in shocked ISM
  2. Calculated field time evolution by solving **induction equation for MHD**

Results


Shock Radius (R_{sh}) [parsec]
Free wind
Shocked wind
shocked ISM
0
20
40
60
80
Shock Velocity [1e3 km. sec^{-1}]
FS&another shock merging
FS&LBV shell
FS&CD
FS&WT
0
2
4
6
Compression ratio
2
3
4
0
10
20
30
40
t[kyr]

Results

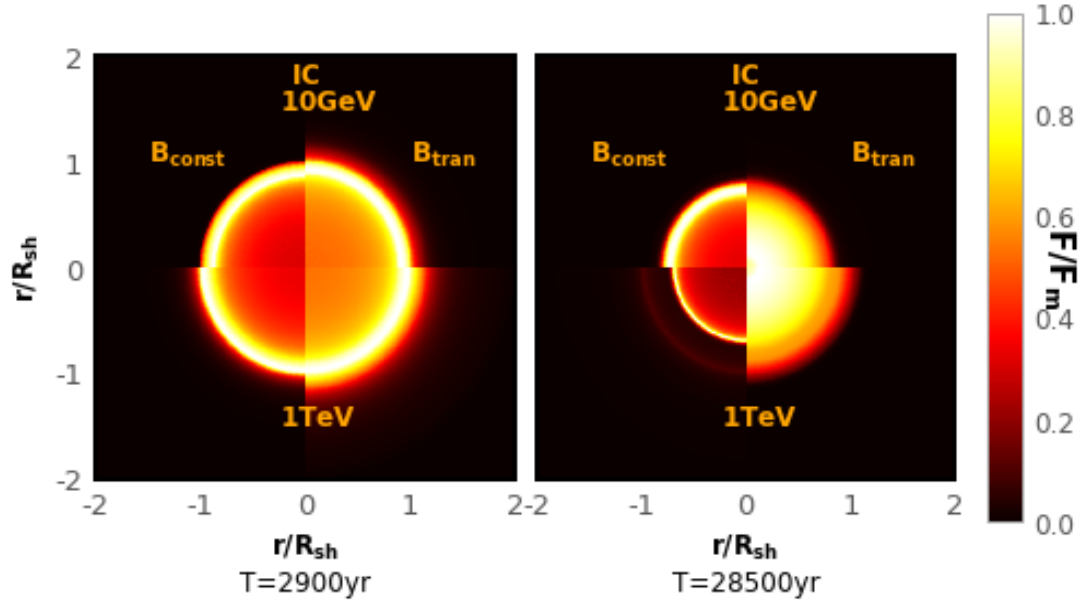
Proton→ Forward shock total downstream spectra



- **Softer spectra** originated in **hot shocked wind**
- **lower maximum achievable energy** for B_{tran}

Results

Non-thermal emission map→ Inverse compton (IC) dominated



- Upper half→ 10GeV
- Lower half→ 1TeV
- Left half→ B_{const}
- right half→ B_{tran}

⇒ SNR emission morphology looks different with B_{const}, B_{tran}

⇒ Realistic B_{tran} gives centre-filled emission with time evolution

Conclusion

- Spectral shape depends on the **temperature**, **FS interactions** and **magnetic field** of the bubble.
- Spectral index of cosmic ray spectra reaches 2.5 with time.
- The magnetic field can have an extensive impact on emission from SNR.

Thank You

for your attention!

References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