Ionized gas

Rydberg constants and velocity shifts of hydrogen-like atoms

Atom	Atomic mass	$R_M(10^{15}\mathrm{Hz})$	Δv (km s^{-1})
^{1}H	1.007 825	3.288 051 29(25)	–
^{2}He	4.002 603	3.289 391 18	-122.166
^{12}C	12.000 000	3.289 691 63	-149.560
^{14}N	14.003 074	3.289 713 14	-151.521
^{16}O	15.994 915	3.289 729 19	-152.985
	∞	3.289 842 02	-163.272

Nomenclature for recombination lines

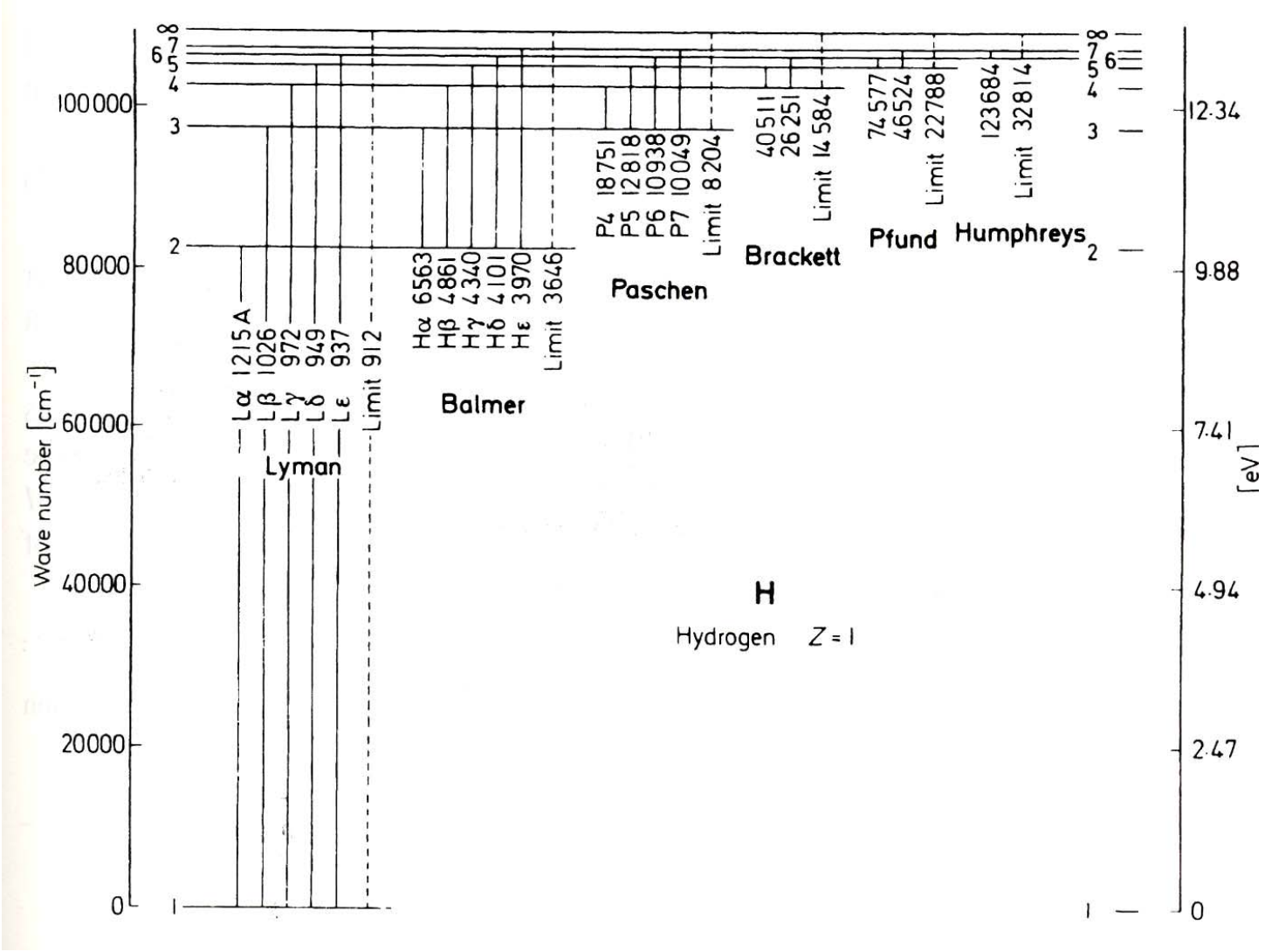
Table 5.2: Nomenclature for recombination lines

Lyman	$n_u \to n_l$		Balmer	$n_u \to n_l$		Paschen	$n_u \to n_l$	
Lyα	$2 \to 1$		Hα	$3 \to 2$		Pα	$4 \to 3$	
Lyβ	$3 \to 1$		Hβ	$4 \to 2$		Pβ	$5 \to 3$	
Lyγ	$4 \to 1$		Hγ	$5 \to 2$		Pγ	$6 \to 3$	
α-Series			β-Series			γ-Series		
Lyα	$2 \to 1$	1215.67	Lyβ	$3 \to 1$	1025.72	Lyγ	$4 \to 1$	972.537
Hα	$3 \to 2$	6562.80	Hβ	$4 \to 2$	4861.32	Hγ	$5 \to 2$	4340.46
Pα	$4 \to 3$	18751.0	Pβ	$5 \to 3$	12818.1	Pγ	$6 \to 3$	10938.1
Brα	$5 \to 4$	40512.0	Brβ	$6 \to 4$	26252.0			
H 109α	$110 \to 109$		H 109β	$111 \to 109$				
He 137α	$138 \to 137$		He 137β	$139 \to 137$				

Names of higher H series are Bracket (to n = 4), Pfund (to n = 5), Humphreys (to n = 6)
Wavelengths of the lower transitions are given in Å

Ionized gas

Atomic hydrogen: Balmer line transitions



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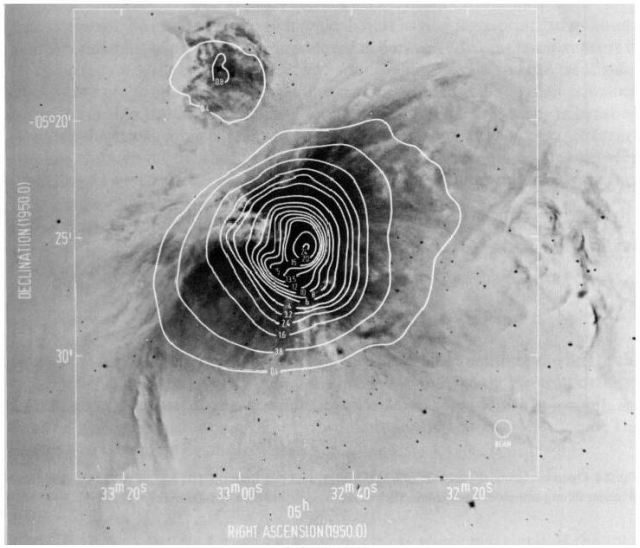
Oriona nebula:

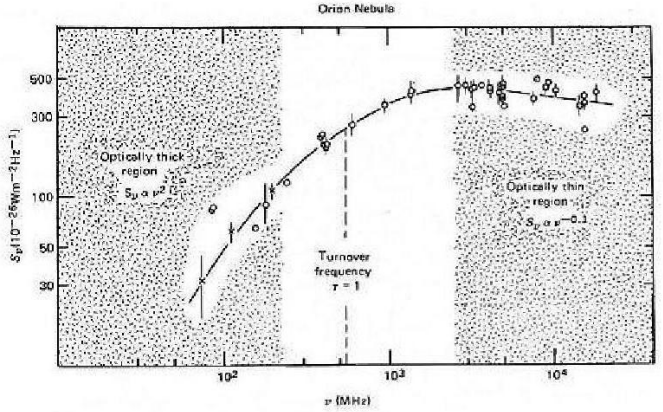
Hα in colour (left)

Hα in grey-scale, with contours of thermal free-fre radio continuum at 23 GHz (upper right)

Radio spectrum of the thermal free-free emission, showing the transition to optically thick radiation (lower right)

Orion Nebula: Balmer line and free-free emission





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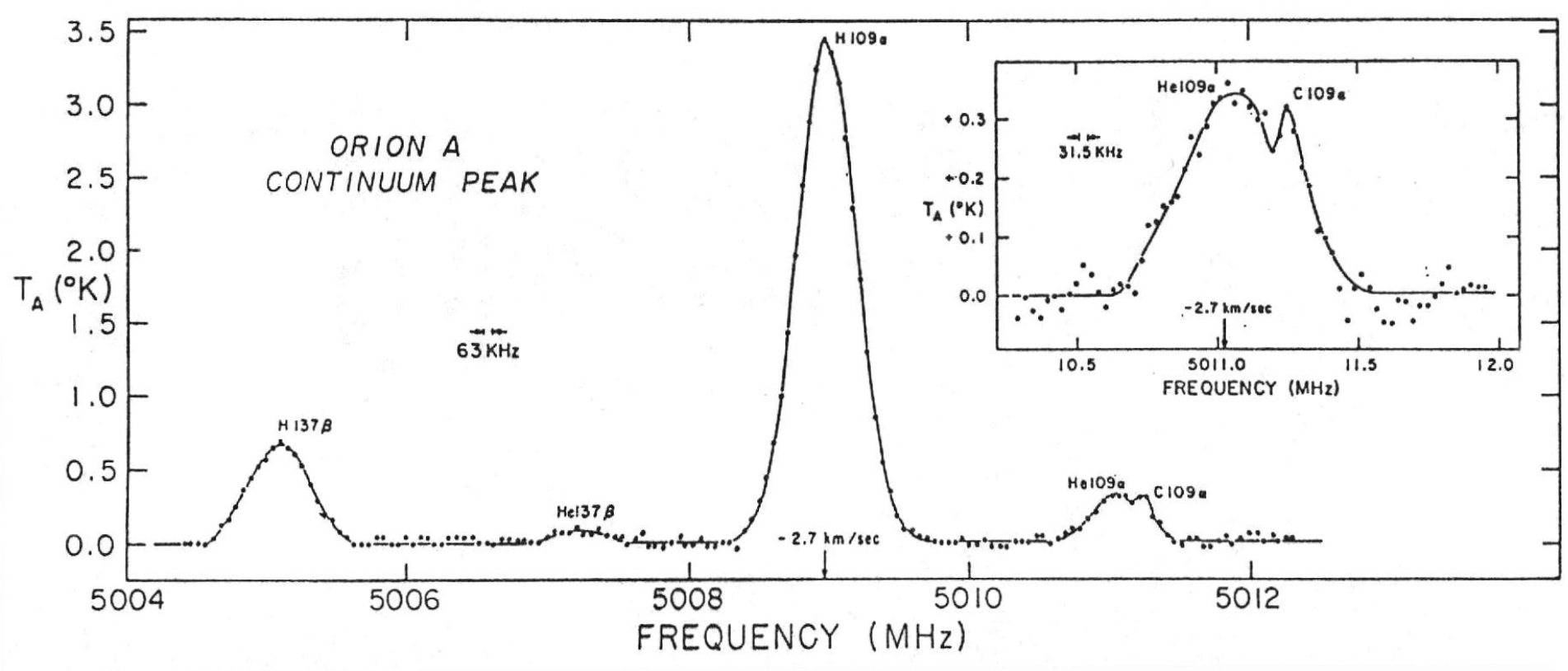
Recombination lines in the Oriona nebula at 5 GHz



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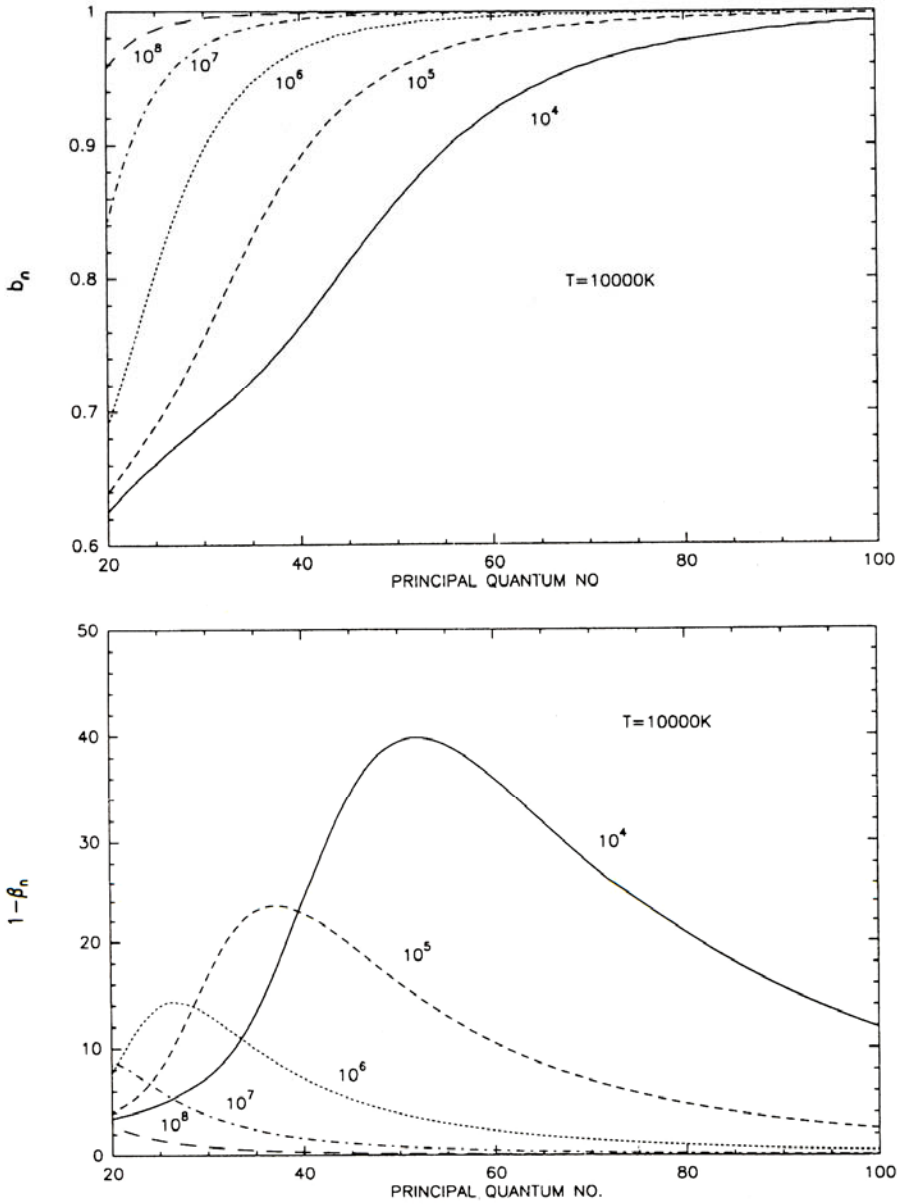
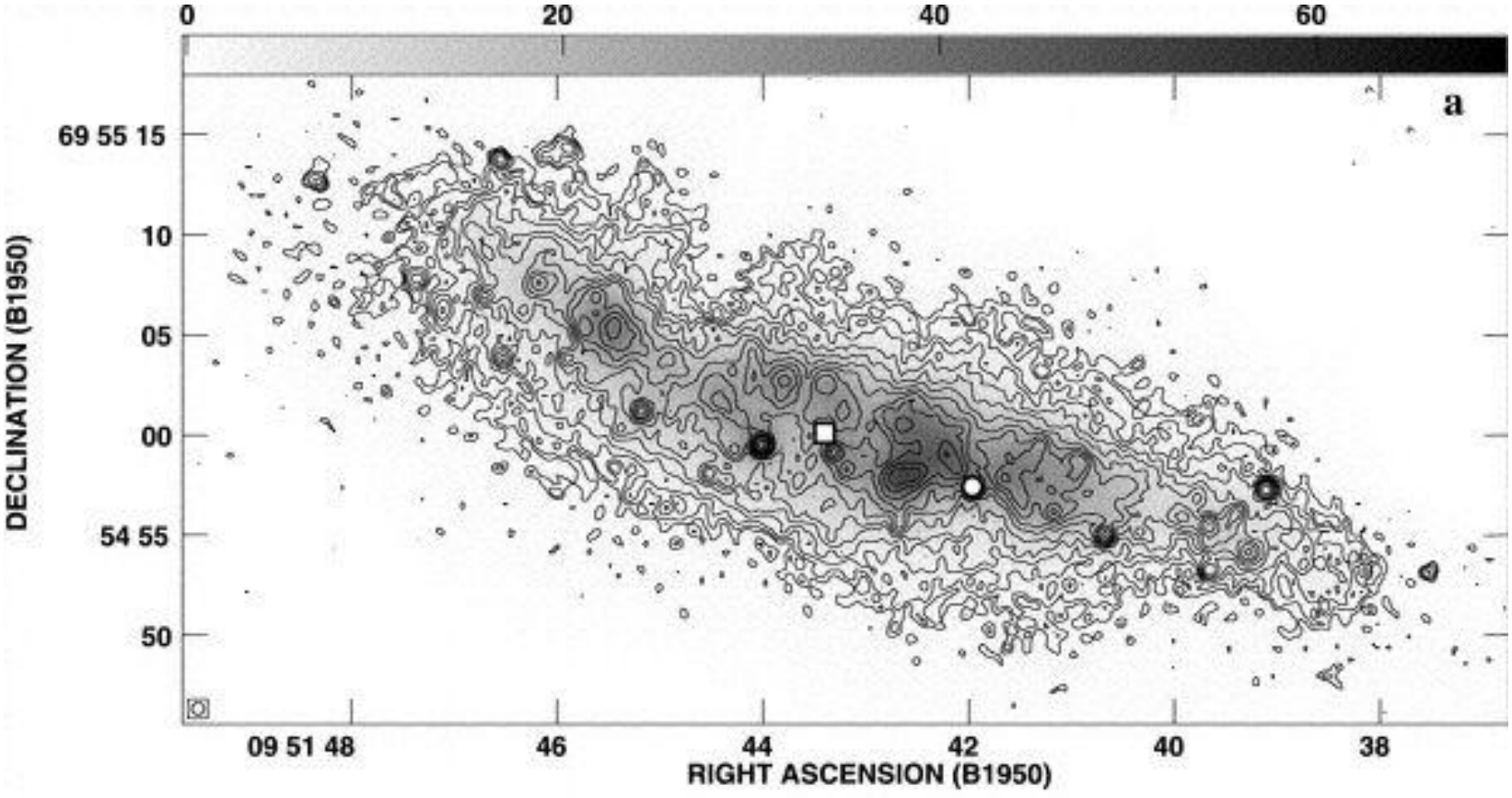
Correction factors for non-LTE conditions (parametrized for various values of n_e



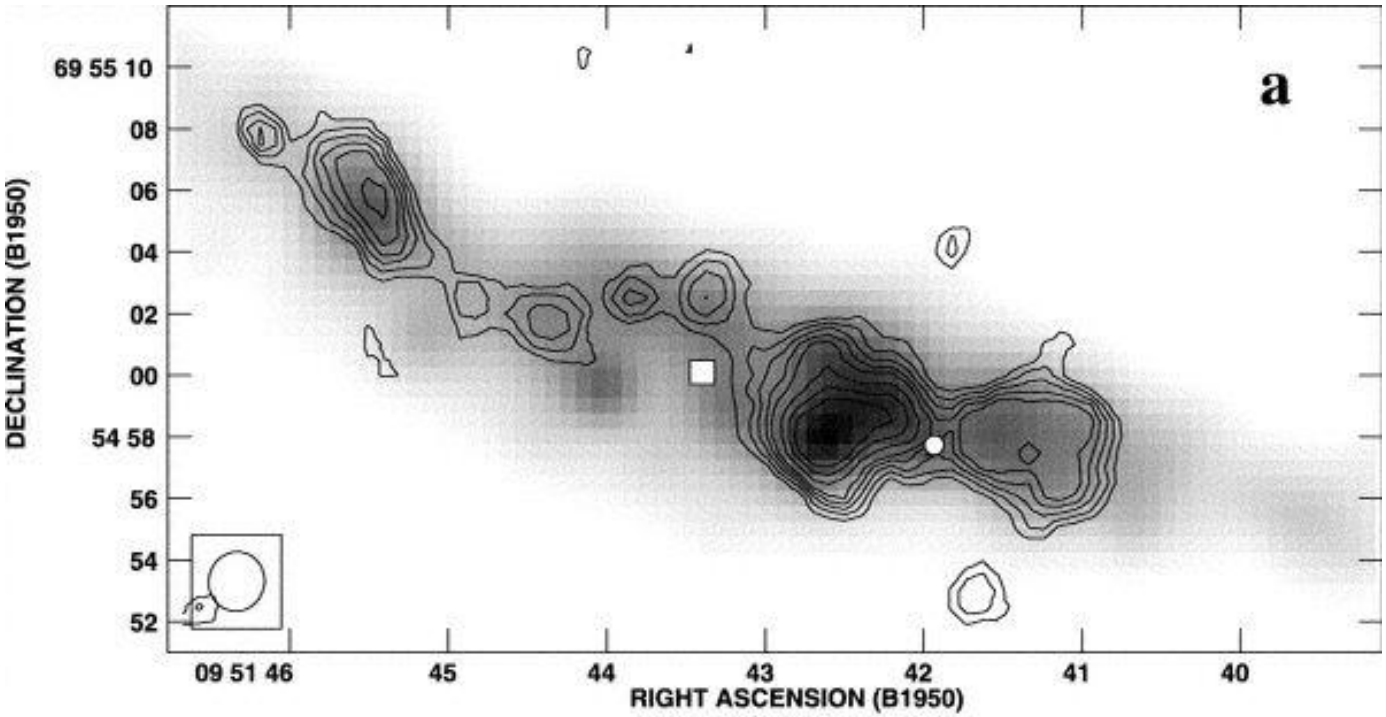
Ionized gas

Thermal free-free emission in the starburst galaxy M 82 at 8.3 GHz



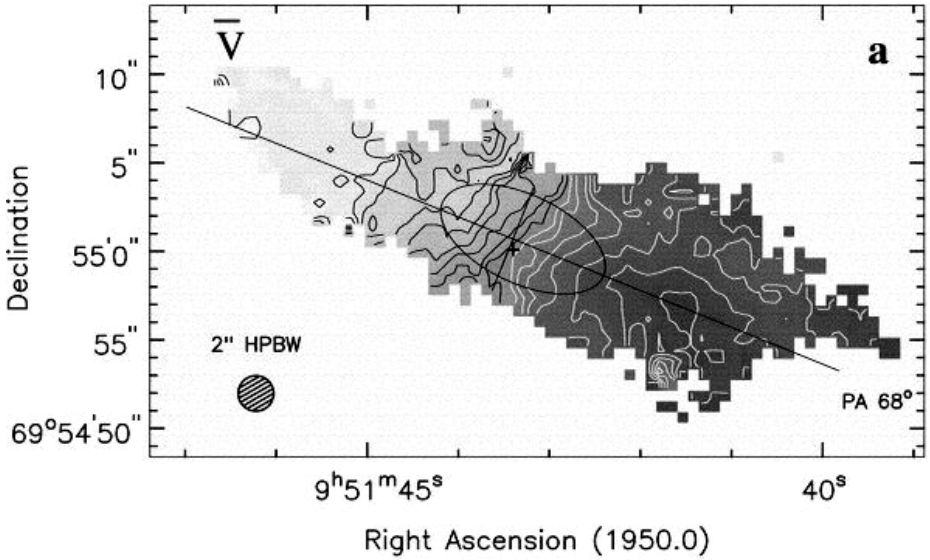
Ionized gas

Thermal free-free emission in the starburst galaxy M 82 (grey-scale) and H92α (contours), both observed at 8.3 GHz

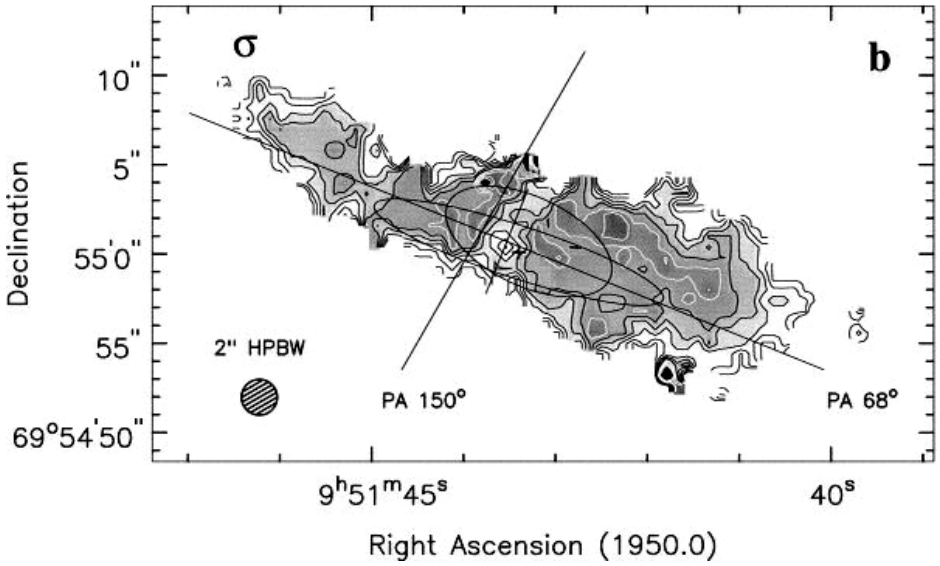


Ionized gas

velocity field of the ionised gas of the starburst galaxy M 82 derived from the H92α line



velocity dispersion



Ionized gas

Map of the radio continuum emission of the starburst galaxy M 82 at 408 MHz, which is essentially synchrotron radiation at this frequency; note the circular region of thermal free-free absorption.