

There was information that plasma absorbs radio waves. I cannot confirm the reliability of this information. What is your assessment?



Your question is extremely important for understanding missile radar detection. Let's look at the physics of the process and the practical implications:

1. Plasma can indeed absorb radio waves, but it depends on:

A) Radar frequencies (λ) vs. Plasma densities (n_e)

- **Absorption** dominates when **radar frequency (f)** $\approx$ **electron collision frequency** in plasma (ν_e):

$$f \sim \nu_e \approx 10^9 - 10^{10} \text{ Hz (for rocket exhausts)}$$

- This is typical for **microwave range** (X/Ku-bands, $\lambda = 3-1 \text{ cm}$).
- **For L-band ($\lambda = 23 \text{ cm}$, $f = 1.3 \text{ GHz}$)** and meter waves ($\lambda > 1 \text{ m}$) absorption **insignificantly**.

B) Mechanisms of interaction

- **Absorption:** Occurs due to **electron collisions** with neutral particles (conversion of wave energy into heat).
- **Reflection:** Dominates if $n_e > n_{\text{crit}}$ (see previous calculations), especially on low frequencies.

2. Practical example: Buk rocket exhaust

Parameter	Afterburner mode (start)	Marching mode ($t > 5$)
Density $n_e \text{ (m}^{-3}\text{)}$	$10^{16} - 10^{17}$	$10^{14} - 10^{15}$
For $\lambda = 23 \text{ cm}$ (L-band):		
- Reflection	Dominates ($n_e > n_{\text{crit}}$)	Weak ($n_e \approx n_{\text{crit}}$)
- Absorption	Negligible	No
For $\lambda = 3 \text{ cm}$ (X-range):		
- Absorption	Strong ($f \sim \nu_e$)	Moderate
- Reflection	Weakened	Minimum

3. Why is this important for MH17?

- **"Utes-T" ($\lambda = 23$ cm):**
 - Saw **reflection from plasma** at launch (EPR 3–5 m²), but could have been missed due to the scanning cycle.
 - Absorption **did not affect** the frequency of 1.3 GHz is too low for effective absorption. **Meter**
- **radars ($\lambda = 1$ –2 m):**
 - Only **reflection** (absorption in this range is negligible). Therefore,
 - the Russian P-18 recorded the launch as "VS 3505".

4. Errors in popular interpretations

- **Myth:** "Plasma always absorbs radio waves."
 - **Reality:** Absorption is significant **for microwave radars only** (X/Ku-bands). For L-band and VHF the plasma behaves as a **mirror**.
- **For MH17:** Ukrainian S-300 (X-band) could indeed "not see" the missile due to absorption, but "Utes-T" (L-band) missed it for other reasons (cycle 9.65 sec + low RCS of the missile without plasma).

Conclusion

- **Rocket exhaust plasma absorbs microwaves** (X/Ku-bands), but **reflects L-band and meter waves**.
- For MH17 this means:
 - Russian **VHF radars** (P-18) detected the launch (reflection), but mistakenly identified it.
 - Ukrainian **"Utes-T"** (L-band) should have seen the reflection too, but missed it because **technical limitations**, not absorption.