Compliance sheet — star-doppler

Everything a supplier qualification, a legal review or an export check usually asks about star-doppler 0.1.0, in one document.

1. Identity

Document	STAR-PKG-STAR-DOPPLER-EN · v2.3 · 2026-11-14
Package	star-doppler
Version	0.1.0
Capability	star.link.doppler
Maturity	Released & Verified (RELEASED)
Python	>=3.9
Source commit	dc09f61d
Source	https://github.com/Andrea07072000/S.T.A.R.-/tree/main/packages/star_doppler

2. Licence and obligations

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3. What it needs at run time

Nothing beyond the Python standard library: it works offline.

4. Integrity

SHA-256 fingerprints of the files published on this website. Check a downloaded file with:

```
python -c "import
hashlib,sys;print(hashlib.sha256(open(sys.argv[1],'rb').read()).hexdigest())" star_doppler-
0.1.0-py3-none-any.whl
```

FILE	SHA-256
star_doppler-0.1.0-py3-none-any.whl	271e2accdcdd4a612d9d25877364ed040ceb7361457f5a1c8c08b4c65ce77583
star_doppler.py	49a6510401642b89f441d9ad486cc43a44af31efb7d038f876fdf889141e57fa
star_doppler-0.1.0-source.zip	d1b1023c92a0fbedf6a3a059b6d58102a2b7895b0795f48684003c11bfd11262

5. What it does, and its limits

Range and range rate between two states and the frequency received over that link, by the longitudinal relativistic formula or the first-order one; on 600 pairs of states and range rates up to 0.9 c the results agree with NAIF SPICE (vnorm, dvnorm), astropy's Doppler equivalencies, NumPy and mpmath at 40 digits within 8.3e-16 of their natural scale.

A geometric, instantaneous, one-way result: no light-time correction (the states must already refer to the right instants), no two-way or coherent turn-around ratio, no transverse relativistic term (the relativistic formula is exact only for motion along the line of sight; the neglected term is of order $(v/c)^2$, the same order as the difference between the two formulas), no gravitational shift, no troposphere or ionosphere, no oscillator error. For a low orbit those omissions are of the order of a hertz at S band: enough to plan a receiver bandwidth, not to do orbit determination.

- `range_and_rate(r_observer, v_observer, r_target, v_target)` returns the distance and the component of the relative velocity along the line of sight, positive when the two move apart. Any frame and units, the same for all.
- `received_frequency(frequency, range_rate, relativistic=True)` returns f sqrt((1 − b)/(1 + b)) with b = range_rate / c, or the first-order f (1 − b) with `relativistic=False`; `C_KM_S` = 299792.458 km/s.
- Measured on 600 pairs of states and range rates up to 0.9 c: range, range rate and both frequencies agree with NAIF SPICE (`vnorm`, `dvnorm`), astropy's Doppler equivalencies, NumPy and mpmath at 40 digits within 8.3e-16 of their natural scale (the relative speed for the range rate).
- Every function returns floats or raises `ValueError`: vectors that are not three finite numbers within 1e15, coincident positions, a frequency that is not positive and finite, a range rate that reaches the

speed of light, `relativistic` that is not a bool.

6. Export, use and certification

The package is published and freely available. That usually takes software out of export-control lists, but not every use of it: read the page on space activities and export control before using it in a controlled programme. It is not certified or qualified for flight; the evidence describes what was tested and how.

7. Citation and bill of materials

```
@software{cavazzini_star_doppler_0_1_0,
  author  = {Cavazzini, Andrea},
  title   = {{star-doppler}: Range, range rate and one-way Doppler shift},
  version = {0.1.0},
  year    = {2026},
  url     = {https://andrea07072000.github.io/S.T.A.R.-/software/star_doppler/},
  note    = {Apache-2.0. Source: https://github.com/Andrea07072000/S.T.A.R.-, commit dc09f61d}
}
```

CITATION.cff · BibTeX · SBOM CycloneDX 1.5 · SBOM SPDX 2.3

8. Warranty and liability

Provided "as is", without warranties or conditions of any kind (Apache License 2.0, sections 7 and 8), to the extent the law allows. This never excludes liability that the law does not allow to exclude.

Related: space activities and export control · acceptable use · evidence and limits · licence texts