H-alpha Solar Flares

For many years NGDC prepared comprehensive solar flare listings in cooperation with the Department d'Astronomie Solaire et Planetaire, Observatoire de Paris, 92190 Meudon, France. For each distinct flare event, the table gives a group report line, which closely resembles the one-line summaries published later in the IAU Quarterly Bulletin on Solar Activity. Group-lines condense and average all individual flare reports of the same event; they give the best estimate of flare time, size and position. NGDC assigned station reports to a group by matching heliographic latitudes; central meridian distances; central meridian passage dates; and start times, maximum times and end times. In Solar-Geophysical Data (SGD) reports, the individual flare reports followed each group-line; in the Quarterly Bulletin, only this summary line appeared.

Beginning with the February 1982 data, NGDC published the grouped listings in SGD before consulting with Meudon. This helped NGDC bring their listings up-to-date although the listings were considered "preliminary". NGDC maintained the final listings after Meudon made their final editing changes.

The statements below describe the measurements for each GROUP-LINE in the flare table.

Grp # — Group serial number. This sequential number ultimately counts the number of flares for the month.

Sta — Station name abbreviation. Blank unless only one flare report is assigned to the group. Station name abbreviations appear in the individual station reports.

Day — Earliest day of reported flare event.

Start (UT) — Earliest Universal Time of flare onset reported within a group (earliest time without a letter qualifier). If all start times have a letter qualifier, then the letter used here is from the earliest time.

When a group contains two or more flares, a single digit immediately following the onset time gives the spread among start times. For example, "13245" means that the start times ranged between 1324 and 1329; an asterisk instead of a number in the last column implies a spread exceeding 9 minutes.

The letter “E” after a start time indicates that the flare began earlier than the tabulated time; the letter “U” means uncertain.

Max (UT) — Earliest Universal Time (UT) within group that flare reached maximum brightness (earliest time without a letter qualifier). If all maximum times have a letter qualifier, then the letter used here is from the earliest time. The letter U following a maximum time stands for uncertain.

End (UT) — Average of flare end times that have no letter qualifier. If all end times are qualified, then the latest end time and its letter qualifier are used. The letter “D” following an end

time means that the flare ended after the tabulated time; the letter "U" indicates uncertainty.

Lat (CMD) Average heliographic latitude and average heliographic central meridian distance (CMD). These two coordinates mark the mean center of mass of the flaring region at its time of maximum brightness.

Region NOAA/USAF assigned serial number of active region in which the flare occurred. The National Oceanic and Atmospheric Administration (NOAA) assigns the region numbers in cooperation with the network of observatories operated by the U.S. Air Force (USAF). Plage regions are matched to the individual flare reports.

CMP Central meridian passage date (Mo/Day) -- the month, the day, and the fraction of day that the flare's position either crossed or would have crossed the sun's central meridian of longitude.

Dur (Min) Duration of the flare in minutes. The letter "D" following a duration means that the flare lasted longer than the number of minutes shown.

Imp (Opt) Average optical importance of flare -- a measurement of flare size and brilliance. The first character in the importance ranks the area of the brightened plage on a 5-level scale; the second character grades the plage brilliance on a 3-level scale. See the table below. Under this classification scheme, an Sf event is the smallest and faintest kind of flare, and a 4b event is the largest and brightest.

	+-------Flare Area--------+		Flare
Imp	Actual	Apparent*	Brilliance
S	A < 2.0	A<200	f,n,b**
1	2.1< A < 5.1	200<A<500	f,n,b
2	5.2< A<12.4	500<A<1200	f,n,b
3	12.5< A <24.7	1200<A<2400	f,n,b
4	A >24.7	A>2400	f,n,b

* Actual area in units of square degrees. Apparent area in millionths of a solar disk.
**f=faint, n=normal, b=bright

The average optical importance of a flare is calculated by substituting numeric values for the area and the brilliance rankings of each report and then calculating the arithmetic mean of each part. The mean of the area classes and the mean of the brightness classes are then converted to their respective 5- and 3-level scales.

Imp (X-ray) Importance of flare at X-ray wavelengths -- the peak flux measure at earth in the 0.1 to 0.8 nm range in units of Watts/sq meter. The letters "C", "M" and "X" stand for powers of 10: "C" denotes the power 10 to the -6, "M" the power 10 to the -5, and "X" any power greater than 10 to the -4. Digits from 1.0 to 9.9 following "C", "M", and "X" act as

multipliers. For example, C3.2 stands for an X-ray burst with a maximum flux of 3.2 x 10E-5 Watts/sq meter.

See — Seeing conditions -- a measurement of the stability of the atmosphere above the observing site. One means poor, 2 fair, and 3 good. Observatories at San Vito, Learmonth, Holloman, Palehua and Ramey use a 1-to-5 scale. The seeing conditions appear in the group-line only when the group contains a single report.

Obs (Type) — Type and completeness of observations -- included only when a group contains a single report. The letter under this heading describes the form of the measurements and their continuity according to the following codes:

- C For either a complete or nearly complete CINEMATOGRAPHIC sequence
- E For an ELECTRONIC measurement
- P For a PHOTOGRAPHIC sequence with either a few photos or only one
- V For either a complete or nearly complete VISUAL record
- S For only a fragmentary visual record

AREA MEASUREMENT

Time (UT) — The Universal Time (UT) of measurement of tabluated flare area given if group contains only one flare.

App (Disk) — Average apparent (projected) area at time of maximum brightness expressed in millionths of the area of the solar disk. Maximum plage brightness and maximum plage area do not necessarily occur simultaneously. If the reported areas scatter by more than a factor of two, no area appears under this column heading.

Corr — Average apparent area corrected for foreshortening and expressed in units of square degrees (sq deg).

Remarks — Each letter of the alphabet stands for one of the noteworthy conditions listed below. The group-line contains an alphabetically sorted collection of all remarks listed with the individual flare reports.

- A Eruptive prominence < 90 degrees from the central meridian.
- B Probably the end of a more important flare.
- C Invisible 10 min earlier.
- D Brilliant point.
- E Two or more brilliant points.
- F Several eruptive centers.
- G No visible spots nearby.
- H Flare accompanied by high-speed dark filament.
- I Active region very extended.
- J Distinct variations in plage intensity before or after flare.
- K Several intensity maxima.
- L Existing filaments suddenly active.
- M White-light flare.

N Continuous spectrum shows polarization effects.
O Observations made in H and K lines of calcium II.
P Flare shows helium D3 in emission.
Q Flare shows Balmer continuum in emission.
R Asymmetry in H-alpha line suggests high speed mass ejection.
S Brightness followed filament disappearance in same position.
T Region active all day.
U Two bright branches, parallel or converging.
V An explosive phase: important expansion in about 1 min that often includes a significant intensity increase.
W Great area increase after time of maximum brightness.
X Unusually wide H-alpha line.
Y System of loop prominences.
Z Major sunspot umbra covered by flare.

The table below lists the solar flare observatories cooperating in the international data exchange through the former World Data Centers as originally established during the International Geophysical Year (IGY). Each observatory is given a four letter station code, the geographic latitude and longitude, the observation type as defined above, and the station name and country.

CONTRIBUTING SOLAR FLARE OBSERVATORIES

Station Code	Geographic Lat	Long	Obs Type	Name
ABST	42N	43E	C	Abastumani,
ATHN	38N	24E	V	Athens, Greece
BUCA	44N	26E	P	Bucharest, Rumania
CATA	38N	15E	C	Catania, Sicily, Italy
HTPR	44N	6E	C	Haute Provence, France
HOLL	32N	254E	E	Holloman AFB, New Mexico, USA
ISTA	41N	32E	P	Istanbul, Turkey
KANZ	47N	14E	C	Kanzelhoehe, Austria
KHAR	49N	37E	P	Kharkov, Ukraine
LARI	39N	22E	V	Larissa, Greece
LEAR	22S	114E	E	Learmonth, Australia
MITK	34N	140E	C	Mitaka, Tokyo, Japan
PALE	21N	202E	C	Palehua, Hawaii, USA
PEKG	40N	116E	P	Peking, People's Rep. of China
RAMY	18N	293E	E	Ramey Air Base, Puerto Rico
SVTO	41N	18E	E	San Vito, Italy
TACH	41N	69E	CP	Tashkent, Uzbekestan
URUM	44N	87E	C	Urumqi, People's Rep. of China
VORO	43N	132E	CPV	Voroshilov (Ussurisk)
WATU	07S	111E	V	Watukosek, Indonesia
YUNN	25N	103E	C	Yunnan, People's Rep. of China