Preferred extremal of K\"ahler action have remained one of the basic poorly defined
notions of TGD. There are pressing motivations for understanding what the attribute
\blockquote{preferred} really means. Symmetries give a clue to the problem. The
conformal invariance of string models naturally generalizes to 4-D invariance defined by
quantum Yangian of quantum affine algebra (Kac-Moody type algebra) characterized by two
complex coordinates and therefore explaining naturally the effective 2-dimensionality
\cite{allb}{Yangian}. Preferred extremal property should rely on this symmetry.

In Zero Energy Ontology (ZEO) preferred extremals are space-time surfaces connecting two
space-like 3-surfaces at the ends of space-time surfaces at boundaries of causal diamond
(CD). A natural looking condition is that the symplectic Noether charges associated with a
sub-algebra of symplectic algebra with conformal weights n-multiples of the weights of
the entire algebra vanish for preferred extremals. These conditions would be classical
counterparts the the condition that super-symplectic sub-algebra annihilates the physical
states. This would give a hierarchy of super-symplectic symmetry breakings and quantum
criticalities having interpretation in terms of hierarchy of Planck constants
$h_{eff}=n\times h$ identified as a hierarchy of dark matter. n could be interpreted as
the number of space-time conformal gauge equivalence classes for space-time sheets
connecting the 3-surfaces at the ends of space-time surface.

There are also many other proposals for what preferred extremal property could mean or
imply. The weak form of electric-magnetic duality combined with the assumption that the
contraction of the K\"ahler current with K\"ahler gauge potential vanishes for preferred
extremals implies that K\"ahler action in Minkowskian space-time regions reduces to
Chern-Simons terms at the light-like orbits of wormhole throats at which the signature of
the induced metric changes its signature from Minkowskian to Euclidian. In regions with
4-D CP_2 projection (wormhole contacts) also a 3-D contribution not assignable to the

boundary of the region might be possible. These conditions pose strong physically feasible
conditions on extremals and might be true for preferred extremals too.

Number theoretic vision leads to a proposal that either the tangent space or normal space
of given point of space-time surface is associative and thus quaternionic. Also the
formulation in terms of quaternion holomorphy and quaternion-K\"ahler property is an
attractive possibility. So called M^8-H duality is a variant of this vision and would
mean that one can map associative/co-associative space-time surfaces from M^8 to H
and also iterate this mapping from H to H to generate entire category of preferred
extremals. The signature of M^4 is a general technical problem. For instance, the
holomorphy in 2 complex variables could correspond to what I have called Hamilton-Jacobi
property. Associativity/co-associativity of the tangent space makes sense also in
Minkowskian signature.

In this chapter various views about preferred extremal property are discussed.